1911-1912

SIXTEENTH
BIENNIAL REPORT

OF THE

STATE ENGINEER

COLORADO

BARKER DAM

Central Colorado Power Company.

Height, 160 Feet. Length, 660 Feet. Reservoir Capacity, 12,000 Acre Feet. J. G. White & Co., Consulting Engineers.

SIXTEENTH BIENNIAL REPORT

OF THE

STATE ENGINEER

TO THE

GOVERNOR OF COLORADO

For the Years 1911-12

DENVER, COLORADO
THE SMITH-BROOKS PRINTING CO., STATE PRINTERS
1913

LETTER OF TRANSMITTAL

Sir: I have the honor to transmit herewith the Sixteenth Biennial Report of the State Engineer's office, covering the period December 1, 1910, to November 30, 1912, inclusive.

Very respectfully,

CHARLES W. COMSTOCK,

State Engineer.

To His Excellency,
JOHN F. SHAFROTH,
Governor of Colorado.

TABLE OF CONTENTS

STATE ENGINEERS OF COLORADO

Since Organization of Department, June 3, 1881.

EUGENE K. STIMSON	June, 1881, to April, 1883
EDWIN S. NETTLETON	April, 1883, to April, 1887
J. SIRE GREENE	April, 1887, to April, 1889
JAMES P. MAXWELL	April, 1889, to April, 1893
CHARLES B. CRAMER	April, 1893, to April, 1895
HORACE A. SUMNER	April, 1895, to April, 1897
JOHN E. FIELD	April, 1897, to April, 1899
ADDISON J. McCUNE	April, 1899, to April, 1903
LOUIS G. CARPENTER	April, 1903, to April, 1905
THOMAS W. JAYCOX	April, 1905, to April, 1909
CHARLES W. COMSTOCK	April, 1909, to April, 1913

LIST OF OFFICERS AND EMPLOYEES, STATE ENGINEERING DEPARTMENT

CHARLES W. COMSTOCK	State Engineer
JUNIUS W. JOHNSON	Deputy State Engineer
ARTHUR F. HEWITT	Deputy State Engineer
THOMAS GRIEVE, JR.	Chief Hydrographer
DELOS L. BUNDY	Hydrographer
MILLS E. BUNGER	Hydrographer
BURKETTE S. CLAYTON	Hydrographer
CHARLES L. CHATFIELD	Hydrographer
CHARLES C. HEZMALHALCH	Hydrographer
CHARLES E. TURNER	Hydrographer
OSCAR L. NELSON	Draftsman
JOHN H. BRADLEY	File Clerk
MARY WOLFE DARGIN	Stenographer
LOUISE D. SMITH	Stenographer
ELLIE H. RHODES	Clerk

IRRIGATION DIVISION ENGINEERS

Div. No. 1	FILLMORE COGSWELL	Denver
Div. No. 2	EDWARD R. CHEW	Pueblo
Div. No. 3	FREDERICK W. SWANSON	Alamosa
Div. No. 4	HEMAN C. GETTY	Delta
Div. No. 5	THEODORE ROSENBERG	Glenwood Springs

WATER COMMISSIONERS

Div. No.	Dist. No.	NAME	ADDRESS	Div. No.	Dist. No.	NAME	ADDRESS
1	1	J. K. Samples	Brush, Colo.	5	37	L. W. Spangler	Gypsum, Colo.
1	2	James P. Higgins	Brighton, Colo.	5	38	Lewis H. Roberts	Aspen, Colo.
1	3	John L. Armstrong	Fort Collins, Colo.	5	39	William J. Murtle	Newcastle, Colo.
1	4	Howard H. Kelly	Loveland, Colo.	4	40	D. S. Doughty	Delta, Colo.
1	5	N. C. Sullivan	Longmont, Colo.	4	41	A. J. Baxter	Montrose, Colo.
1	6	James Platt	Boulder, Colo.	4	42	George M. Saunders	Mesa, Colo.
1	7	William M. Elliott	Golden, Colo.	5	43	James Mikkelson	Sulphur, Colo.
1	8	A. E. Gray	Littleton, Colo.	5	44	Arthur Collom	Axial, Colo.
1	9	L. E. Ewan	Morrison, Colo.	5	45	R. W. McQuirk	Grand Valley, Colo.
2	10	William Frizzell	Manitou, Colo.	1	46	J. P. Vaughn	Walden, Colo.
2	11	Max Dickman	Poncha Springs, Colo.	1	47	Henry J. Howard	Rand, Colo.
2	12	D. S. Jones	Florence, Colo.	1	48	R. E. Moan	Gleneyre, Colo.
2	13	H. W. Hendershot	Silver Cliff, Colo.	2	49	No commissioner	
2	14	H. R. Thomson	Pueblo, Colo.	5	50	No commissioner	
2	15	S. T. Curtis	Beulah, Colo.	5	51	No commissioner	
2	16	Parson S. Brown	Walsenburg, Colo.	5	52	Clarence Rundell	Sheephorn, Colo.
2	17	Benjamin G. Wilson	Rocky Ford, Colo.	5	53	No commissioner	
2	18	No commissioner		5	54	E. W. Leggett	Baggs, Wyo.
2	19	A. C. Windham	Trinidad, Colo.	5	55	No commissioner	
3	20	Z. J. Wilson	Del Norte, Colo.	5	56	No commissioner	
3	21	Thomas McCunniff	La Jara, Colo.	5	57	No commissioner	
3	22	Jesse Reynolds	Manassa, Colo.	5	58	F. D. Hutchinson	Yampa, Colo.
1-2	23	Alonzo Wright	Pine, Colo.	4	59	F. W. Harper	Gunnison, Colo.
3	24	J. P. Sanchez	San Pablo, Colo.	4	60	H. C. Browning	Norwood, Colo.
3	25	John L. Charles	Crestone, Colo.	4	61	W. S. Jones	Paradox, Colo.
3	26	Alexander Russell	Saguache, Colo.	4	62	W. O. Brower	Cimarron, Colo.
3	27	Arthur N. Coolbroth	La Garita, Colo.	4	63	No commissioner	
4	28	J. Roy Hicks, Jr.	Sargents, Colo.	1	64	John O. Shay	Sterling, Colo.
4	29	Robert H. Bostwick	Pagosa Springs, Colo.	1	65	Howard Funk	Wray, Colo.
4	30	S. M. Campbell	Durango, Colo.	2	66	No commissioner	
4	31	No commissioner		2	67	Harry A. Pettee	Holly, Colo.
4	32	No commissioner		4	68	J. W. Martin	Ridgway, Colo.
4	33	C. E. Allen	Durango, Colo.	4	69	No commissioner	
4	34	T. A. Fielding	Mancos, Colo.	5	70	George F. Newton	De Beque, Colo.
3	35	I. N. Janney	Alamosa, Colo.				
5	36	No commissioner					

CHAPTER I.

THE STATE ENGINEER'S OFFICE AND ITS WORK

The State Engineer's office was originally created for the purpose of supervising the distribution of water from the public streams. From time to time other duties have been prescribed by statute as occasion demanded.

Sections 3322 to 3326, Revised Statutes of Colorado, 1908, which were enacted in 1889, are as follows:

"*3322. General duties of state engineer.*—Sec. 158. The state engineer shall have general supervising control over the public waters of the state. He shall make or cause to be made careful measurements of the flow of the public streams of the state from which water is diverted for any purpose, and compute the discharge of the same. He shall also collect all necessary data and information regarding the location, size, cost and capacity of dams and reservoirs hereafter to be constructed, and like data regarding the feasibility and economical construction of reservoirs on eligible sites, of which he may obtain information, and the useful purposes to which the water from the same may be put. He shall also collect all data and information regarding the snow-fall in the mountains each season, for the purpose of predicting the probable flow of water in the streams of the state, and publish the same.

3323. Shall approve designs and plans.—Sec. 159. The state engineer shall approve the designs and plans for the construction and repair of all dams or reservoir embankments which are built within the state, which equal or exceed ten feet in vertical height.

3324. Supervision over division engineers and water commissioners.—Sec. 160. The state engineer shall have general charge over the work of the division water superintendents and district water commissioners, and shall furnish them with all the data and information necessary for the proper and intelligent discharge of the duties of their offices, and shall require them to report to him at suitable times their official actions, and require of them annual statements, on blanks to be furnished by him, of the amount of water diverted from the public streams in their respective divisions and districts, and such other statistics as, in the judgment of the state engineer, will be of benefit to the state.

3325. Additional duties of engineer.—Sec. 161. The state engineer shall, without any extra pay or compensation beyond the salary provided in section one of this act, perform all duties imposed upon him by law, and shall when called upon by the governor, give his counsel and services, without extra pay or compensation, to any state department or institution; *Provided, however,* That he shall be allowed all actual traveling and other necessary expenses, and the actual cost of preparing necessary maps and drawings, which actual expenses shall be paid by the department or institution requiring his services.

3326. Appoint deputy for special work.—Sec. 162. The state engineer shall, on request of any party interested and on payment of his per diem charges and reasonable expenses, appoint a deputy to measure, compute and ascertain all necessary data of any canal, dam, reservoir or other construction, as required or as may be desired to establish court decrees, or for filing statements, in compliance with law, in the county clerk's records."

A perusal of these will show that the duties of the State Engineer's office are many and exacting. Notwithstanding this fact, the legislature from time to time enacts laws imposing other duties on the office, either by way of special investigation of some engineering subject of general interest, or as a member of a board charged with the construction of a road, bridge, or artesian well.

Some of the duties have never been performed, chiefly for lack of funds and the technical assistance which these funds would provide. For instance, Section 3322, above quoted, provides that the State Engineer shall investigate the possibilities in the way of economical reservoir construction.

Presumably it is not contemplated that the State will invest its own money in the construction of reservoirs, but the collection and dissemination of such information would go far towards attracting private capital to developments of this kind.

That these investigations are of general interest, and that information of this kind is much sought after, are shown by the great demand for, and the general use of, Part II of the Twelfth Annual Report of the United States Geological Survey, which report contains valuable data relative to a large number of reservoir sites in the western states collected by the employees of the Geological Survey.

To carry out the purposes of this provision, however, would require exploration by practiced field engineers, trained in rapid reconnoissance work and supplied with a fund of information on the storage, distribution and use of water.

The same section provides that the State Engineer shall collect information relative to the snow-fall in the mountains each season, with a view to predicting the probable stages of the streams during the following spring and summer, and that he shall publish this information.

I believe that some work of this kind has been attempted in the past, but with indifferent results. A complete organization for this purpose would probably be very expensive, and several years would elapse before the beneficial results of such forecasting would be apparent.

Notwithstanding this, it becomes every year more and more evident that a beginning must be made in this direction. Each year it becomes more and more important to agriculturists that they should be able to count with a reasonable degree of certainty upon the water prospect for the coming season. Each year the inquiries along this line increase in number, and this question is rapidly assuming a position second only in importance to the weather forecasts of the United States Weather Bureau.

That bureau has done something towards predicting river stages. It has made many studies and has, at least, the beginning of an organization which might accomplish great good in the semi-arid regions.

If the legislature could provide some funds and authorize co-operation with the United States Weather Bureau, this one requirement of the State Engineer's office would not be a "dead letter."

Section 3326, above quoted, seems to contemplate the use of the State Engineer's office to assist the district courts in the adjudication of water rights. This is a wise provision, and it is believed that the information in the hands of this office could be used to advantage in many adjudication proceedings. However, during my incumbency of the office no requests have been made by any of the district courts for information or assistance, such as this office could give.

Much work along this line could be done by the present office force, and without any increase in expense to the State. In its very nature, however, this is a class of work which cannot be initiated by this office, and which can only be done on request of the court, or of some party to an adjudication proceeding.

The actual work, on which the time, money and energies of the State Engineer's office have been expended, may be classified under the seven following heads:

1. Office and clerical work in connection with the filing of claims to water rights.
2. Control of streams and supervision of water distribution therefrom.
3. Examination of reservoir plans and specifications, supervision of dam construction, and inspection of existing reservoirs.
4. Hydrographic work, including measurements of stream flow and study of water resources of the state.
5. Investigation of irrigation projects under the Carey Act, and reports to the State Board of Land Commissioners on their water supply and general feasibility.
6. Design and construction of bridges and roads.
7. Engineering work for other departments of the State government, to whatever extent may be necessary.

The distribution under these various headings varies greatly from year to year. That under the first two is fairly uniform, with a gradual tendency towards increase. Under the third head the variation is greater, but on the whole the work has increased to such an extent as to involve much hard work and a great deal of responsibility. Under the fifth heading the quantity of work depends entirely upon the activities of promoters. The work under the sixth heading is dependent upon the acts of the legislature, and varies from almost nothing to more than can be properly accomplished with the present office force. The quantity of work involved under the seventh and last heading is subject to great variation, but has at no time during my incumbency been burdensome.

OFFICE AND CLERICAL WORK

The Eighteenth General Assembly enacted a law modifying the requirements for filing claims to water rights in the State Engineer's office to an extent which very materially reduced the clerical work involved, and the chance of error on the part of this office.

This law is Chapter 228, Session Laws of 1911. It requires the filing of only one map instead of duplicates, as formerly, and provides for filing blue print copies in the office of the county clerk.

This does away with the necessity for comparing duplicates in the State Engineer's office, and practically nullifies the chance of error. It further does away with the possibility of altering the duplicate after its return to the claimant and before it is filed with the county clerk.

This same act changed the form of the State Engineer's endorsement to a mere acceptance for filing instead of the former certification of examination and approval. The certificate required by the old law had been misused and misrepresented by unscrupulous promoters to such an extent that a change in the form was imperative.

During the period December 1, 1910, to November 30, 1912, inclusive, there have been filed 1,820 maps, covering appropriations of water for 1,658 ditches and 763 reservoirs.

During the corresponding period two years ago the number of maps filed was 2,751. There has, therefore, been a reduction of about one-third in the number of filings. This reduction is attributable to two causes.

The first, and more important, is the general decrease in business activity, particularly in irrigation enterprises, during the years 1911-1912, as compared with the two preceding years.

The second is much more trivial, but has undoubtedly had an effect. This is the very substantial increase in the fees payable to the State Engineer's office provided by an act of the Eighteenth General Assembly.

This increase has not acted as a deterrent on *bona fide* enterprises, but has unquestionably prevented the filing of a great many speculative claims. These are usually for large quantities of water, and the fees payable under the present law are large.

This assumption seems to be justified by the fact that most of the claims filed during the past two years have been for quantities of water not exceeding twenty cubic feet per second, for which the minimum filing fee of ten dollars is payable. Claims of this kind are almost sure to be followed by actual work and real development. There is no speculative profit in small quantities of water.

The index system, referred to in Chapter I of the Fifteenth Biennial Report, has been completed as to three of the four classifications outlined. Two of these completed indices are on the card system, and the third is a loose-leaf book index.

In the first card index the titles of the various claims filed are arranged alphabetically. The cards are 4 x 6 inches, and are printed according to the following form:

File No. Title

Dist. No. Div. No. Filed Com. of work

Source of supply

Claimant

Canal width on Top Bottom Depth Length

Claim for canal cu. ft. per sec.; Res. cu. ft.

Res. Ht. of Dam Area high water line Acres

Headgate Bears ft. from

Cor. Sec. T. R. P. M.

Initial pt. of survey Bears ft. from

Cor. Sec. T. R. P. M.

No. of cards No. of sheets

STATE ENGINEER OF COLORADO

The blanks are filled in on the typewriter.

The number of cards in this index is 25,000.

In the second card index the names of the claimants are arranged in alphabetical order. These cards are also 4 x 6 inches and are printed according to the following form, the blanks being filled in on the typewriter:

File No. Claimant

Title

Source of Supply

Dist. No. Div. No.

STATE ENGINEER OF COLORADO

The number of cards in this index is 23,000.

The third index is a loose-leaf book index, in which the filings in each district are grouped together in the order of their filing numbers. This is equivalent to a chronological arrangement in each district.

All entries in these books are typewritten. Each page of these index books carries the following headings. under each of which an entry is made for each filing:

Filing Number.

Name of Canal or Reservoir.

Source of Supply.

Date of Filing.

Date from Which Water Is Claimed.

Capacity Claimed, Reservoirs in Cubic Feet, Canals in Cubic Feet per Second.

Location of Headgate or Dam, Sec., Twp., Range, P.M.

Owner.

Address.

Filing Number.

26,600 titles are entered in these books.

The three indices above described are completed and kept up to date. Every claim filed in this office is represented in each index, some of them by several cards each.

The total number of claims filed is about 17,000, and it is apparent from the above description that all have been thoroughly cross-indexed.

The fourth index is on the card system, and in it the names of the sources of supply are arranged alphabetically. The cards are of the same size as for the other indices, and are printed in the following form:

File No. Source of Supply

Title

Claimant

Dist. No. Div. No.

STATE ENGINEER OF COLORADO

In these, as in the others, the blanks are filled in on the typewriter.

The number of cards in this index up to date is 15,000, but the work on it is not complete, and no cases have been provided for the storage of the cards.

It will be apparent from these descriptions that most questions relative to water-right claims can be answered directly from the indices, and that the maps and statements themselves can readily be found, from whatever point of view the subject may be approached.

However, there are two questions which are asked with increasing frequency, and which the office is now unable to answer in most cases. One of these questions relates to the ownership of certain claims, and the other to the possibility of irrigating any particular land which may be described.

The first question we should probably not undertake to answer. We can give the names of the claimants by whom the filing was made, but to keep track of the ownership of a claim would require a most elaborate record system similar to that maintained by county recorders.

The second question we should be able to answer. To enable us to do so, however, will require the preparation of large-scale township maps, on which the location of each ditch and reservoir could be plotted by a draftsman in this office as soon as a filing was made.

To keep such a system of maps up to date would not be difficult, but to prepare them and bring them up to date would be a long and arduous task, requiring probably the entire time of one draftsman for two or three years.

Notwithstanding this, I am convinced that such maps, once prepared, would justify the expenditure of the five thousand dollars which they would probably cost.

SUPERVISION OF WATER DISTRIBUTION

Details of this subject are treated in a subsequent chapter which contains the reports of the irrigation division engineers for 1911-12. In another chapter will be found abstracts of reports of the water commissioners, showing various data with regard to the use and storage of water by various ditches and reservoirs.

By reference to the tables prepared from the water commissioners' reports it will be observed that the range in the duty of water is very great. In a few instances it appears that less than one acre-foot per acre has been diverted by the canals. In some others more than ten acre-feet per acre have been used. Making all allowance for the requirements of different crops and for the peculiarities of different soils, there seems to be no reason for these extreme variations.

The first step towards correcting them is to make sure that our figures are correct. In order to do that, it is necessary to impress upon the water commissioners that the preparation of their annual reports is just as necessary as the distribution of water.

Most of them are quite willing to undertake the preparation of careful reports, if they are allowed the time to do so. In many cases, however, the county commissioners warn the water commissioners that they will not pay for time spent in such work, and the water commissioners, as a result, prepare their reports hastily and sometimes inaccurately. This condition of affairs should be remedied in some way.

It is extremely difficult, if not impossible, to maintain an efficient organization unless each member acknowledges and respects the authority of his superior. The division engineers at the present time labor under a very considerable handicap in the performance of their duties, because of their inability to compel water commissioners to execute orders.

It is true that the law provides for the suspension, and even for the removal, of the water commissioner who is insubordinate, but he can scarcely be charged with insubordination for failure to put in time for which he will not be paid. Under the present system, therefore, the county commissioners have it in their power to practically nullify the orders of the division engineers, and many of them do not hesitate to use this power.

If this difficulty can be removed, so that the water commissioners may recognize that they are subordinate only to the division engineers, and to no one else, the system of reports will soon show a vast improvement in detail and in accuracy. We shall then be in a much better position to correct abuses and eliminate waste in the distribution and use of water.

During the biennial period just closed there has been only one notable controversy involving a fundamental principle. This is referred to at some length in the report of Division Engineer Cogswell. It involves the bitterly fought question as to whether there exists an irrigation season and a storage season, under the law. This matter is now pending in the Supreme Court of the State of Colorado.

RESERVOIR SUPERVISION

Under the provisions of section 3205, Revised Statutes of Colorado, 1908, plans and specifications for thirty-seven dams have been submitted to and approved by the State Engineer during the biennial period. No record has been kept of plans submitted, but not approved.

In a subsequent chapter are given the details of these various structures, together with the action of this office in each case. The character of many of the plans submitted is the most striking evidence of the necessity for some regulation of the practice of engineering.

It is impossible for the State Engineer to control the construction of all reservoirs in the State, unless he has the co-operation of the engineers in private practice. This co-operation is freely given by the trained and experienced engineers, all of whom recognize that the purpose of State supervision is to give every possible assistance towards obtaining safe and efficient structures.

On the other hand, those who are ignorant of the fundamental principles of engineering construction are the first to resent suggestions or supervision by the State Engineer. Themselves well aware that they are frauds, pretending to be what they are not, and obtaining their fees under false pretenses, they are quick to resent the recognition of these facts involved in the severe criticisms which the State Engineer is frequently compelled to make of plans submitted.

The statute says that "the State Engineer shall act as consulting engineer." In private practice a consulting engineer is one who advises with and assists the engineer actively in charge of the work. They work as one, making use of the best knowledge of both, and the results are usually better than could have been reached by either working alone.

No doubt the statute intended the term "consulting engineer" in this sense. It certainly did not contemplate that the State Engineer should be compelled to fight the engineer in charge at every turn, in order to insure

safe construction. Yet this is the actual condition with many of the structures which are built, presumably, under the supervision of the State Engineer's office.

The State Engineer insists upon compliance with fundamental and well-recognized principles of construction, and the engineer in charge does everything in his power to evade or violate instructions from this office. This is often done under the plea that to comply with the State Engineer's orders would cost too much money. Occasionally this is true, but generally, not. The real reason, in most instances, is that the engineer in charge feels that the suggestions, not having originated with him, are aspersions on his engineering ability.

I repeat that these difficulties do not arise with those who are really entitled to be called engineers. Such men are familiar, not only with fundamental principles, but with the innumerable details which one learns from long experience and contact with a large variety of work. The State Engineer, therefore, seldom has anything to criticise or suggest in plans and specifications prepared by such men. If a difference of opinion does arise, it is easily adjusted by consultation, just as it would be in private practice.

While economy is important, the first and most important consideration in reservoir construction must be *safety*. To insure this the practice of engineering must be restricted to men who have, at least, a certain specified minimum of training and experience.

The practice of medicine is very properly limited in this way, for the lives of people are in the hands of those who are permitted to prescribe drugs or to wield the knife. The practice of law is equally restricted, although in most cases only property rights, and not human lives, are at stake.

The practice of engineering, however, is open to every one, although an ignorant engineer may by one blunder cause more damage to life and property than any ten physicians or lawyers could possibly cause in their entire careers. It is only necessary to refer to some of the reservoir failures of about three years ago to illustrate this point.

Most fortunately, these did not result in any loss of life, but they could easily have done so, and they did, as a matter of fact, cause enormous damage. It is probable that nearly, if not quite, all of these failures would have been avoided if the question of low first cost had not been allowed to dominate the design and construction, and to outweigh every consideration of safety. It is easy for one who knows nothing of engineering principles and is, therefore, unable to form an independent judgment of the merits of different types of construction, to persuade himself that what is cheapest is best.

During the past two years we have not been afflicted with the series of disastrous reservoir failures which occurred in the preceding biennial period. Only two actual failures have come to the attention of this office, and these, being of relatively small reservoirs located in somewhat out-of-the-way places, attracted no more than local attention, and resulted in comparatively slight property damage.

One of these was the Atkinson reservoir, located about fifteen miles southeast of Collbran, in Mesa county, Colorado, and the other was the Red Mesa reservoir in La Plata county, about twenty-five miles southwest of Durango. The first failed in June and the second in July, 1911.

The Atkinson reservoir failure seems to have been due to defective outlet construction, while in the case of the Red Mesa reservoir, the embankment itself was of insufficient section and improperly constructed. Had they been constructed under competent engineering supervision, it is probable that neither would have failed.

There have, however, been a number of complaints from persons residing or owning property in such locations that they would suffer damage in the event of the failure of certain reservoirs, and in response to these complaints the State Engineer's office has caused examinations to be made from time to time of a large number of reservoirs.

In some instances these examinations have resulted in orders to withdraw a portion of the water stored. In others it was believed that the complaints were unfounded, and no such orders were issued.

It is extremely difficult, if not impossible, to determine definitely from external appearances as to the safety of an existing dam. In most cases there is no record of the design or method of construction, and the engineer has no basis for determination except external appearances. Upon these the examining engineer must base his judgment and assume a very heavy responsibility.

He must choose between running to waste water worth many thousands of dollars, and risking the destruction of property worth perhaps nearly as much, to say nothing of the possible loss of human life. If he chooses to withdraw the water, the dam, of course, does not fail, and he will always stand accused of wasting water without cause. If he chooses the other horn of the dilemma, and a failure does come, he can never cease to reproach himself for a serious error in judgment, particularly, if there should be a loss of life.

With a full appreciation of the weight of this responsibility, I am convinced that Section 3207, Revised Statutes of Colorado, 1908, which provides that the State Engineer shall annually determine the amount of water which it is safe to store in the several reservoirs of the State, should be made more effective than it now is. It is at the present time limited to the examination of such reservoirs as may be complained of by persons living or owning property near them.

There is need for a force of at least two engineers of mature judgment who shall be constantly in the field, investigating with care the condition of reservoirs in all parts of the State. These investigations should not be limited to mere inspections by eye, but should extend to the construction of test pits or sounding wells whenever such may appear to be necessary. The expense of such work would be considerable, but the experience of the few years just passed has been such as to justify it.

Section 3205, Revised Statutes of Colorado, 1908, which gives the State Engineer control over the construction of dams, must be strengthened, if it is to be effective, by the addition of a provision permitting the initiation

by the State Engineer's office, through the attorney general, of injunction proceedings to make impossible the construction of any dam except upon strict compliance with the law.

HYDROGRAPHIC DEPARTMENT

The extent and importance of the work of this department is such that a separate chapter has been devoted to it. Therefore, it receives a mere mention in this place.

CAREY ACT REPORTS

During the biennial period 1909-1910 nine of these projects were proposed to the State Board of Land Commissioners, and by that Board referred to the State Engineer's office for investigation. At that time there was a great "boom" in irrigation securities, and every one seemed anxious to get some kind of paper on the market. After reporting to the State Board of Land Commissioners on the water supply and engineering features of these projects, the connection of the State Engineer's office with them ceases.

I am, therefore, not advised as to what progress has been made toward the development of those projects which were passed on favorably by the State Engineer, and which received the approval of the State Board of Land Commissioners.

During the biennial period just closed the condition of the money market, particularly in its relation to irrigation enterprises, has been very different, and not one new project under the Carey Act has been brought to the State Engineer's attention for an official report.

A few requests to the State Board of Land Commissioners for temporary withdrawals, as provided by a recent amendment to the Carey Act, have been made, and on these the Land Board has sought and received the advice of the State Engineer's office.

These temporary withdrawals are revocable at any time, and can only result in permanent segregations after a thorough examination by and the approval of the State Engineer. It is, therefore, not considered worth while to enumerate the temporary withdrawals, or to refer to the advice given the State Land Board concerning them, since these matters will be found in all their detail in the Biennial Report of the State Board of Land Commissioners.

ROADS AND BRIDGES

It has been customary for many years for the legislature to appropriate from the Internal Improvement Fund various sums for the construction of roads, bridges and artesian wells in different parts of the State, and it has been common practice to create for each of these structures a board of construction, of which the State Engineer should be one member.

The Eighteenth General Assembly failed to make such appropriations, and the work of this department of the State Engineer's office has, therefore, been limited to the completion of those works provided for by the Seventeenth General Assembly, which had not been fully constructed during the preceding biennial period.

All this work has been closed up, and there is no unfinished business remaining in this department. In another chapter will be found a detailed statement as to each piece of work, and a financial statement showing the disposition of the appropriated funds.

In the Fifteenth Biennial Report it was suggested that so far as the bridge work was concerned, a considerable economy could be effected by so wording the appropriation bills as to permit the awarding of one contract for all the structural steel necessary for the construction of all the bridges provided for. In this way the amount of work will be sufficient to tempt some of the larger structural steel shops, and much better prices can be had than by the ordinary process of calling for separate bids on each structure. Should the legislature this year again appropriate for a number of bridges, it is recommended that this suggestion receive consideration. Some pertinent facts are set out in detail on pages 14 and 15 of the Fifteenth Biennial Report, and it is not necessary to repeat them here.

WORK FOR OTHER DEPARTMENTS OF THE STATE GOVERNMENT

Section 3325, Revised Statutes of Colorado, 1908, provides that the State Engineer shall give his counsel and services without extra pay or compensation to any State department or institution.

During the biennial period just closed there have been few calls for the services of this office under the statute above cited.

In one instance, the Warden of the State Reformatory at Buena Vista asked for some advice and assistance in connection with certain proposed new buildings. In response to this call, Mr. J. W. Johnson, Deputy State Engineer, visited Buena Vista, and assisted in obtaining desired information and in the preparation of certain estimates of costs. This work was not made the subject of a formal report and, therefore, receives mention only.

At frequent intervals the State Board of Land Commissioners has requested consultations and advice on matters involving certain engineering questions. In two instances requests were made of that Board to purchase the bonds of certain irrigation districts, and, as required by law, the State Engineer was requested to make investigations and to report results to the Board. This was done, but it is not deemed necessary to go into detail concerning them in this report, since they are within the special province of the State Board of Land Commissioners, and will, therefore, be treated in the report of that Board.

Except in these matters, the counsel given the Land Board has been verbal, and there is nothing concerning it worthy of special report.

SANCHEZ DAM

The Costilla Estates Development Company. Maximum Height, 120 Feet. Length, 1,200 Feet. Reservoir Capacity, 104,000 Acre-Feet.
George G. Anderson and O. V. P. Stout, Consulting Engineers. W. D. Waltman, Resident Engineer

CHAPTER II.

SUGGESTED LEGISLATION

In the Fifteenth Biennial Report of this office a number of suggestions for the improvement of the water service of the State and the removal of certain misunderstandings and apparent conflicts by legislation were made. Some of these are again urged in this report. The acts of the Eighteenth General Assembly removed many of the difficulties complained of two years ago. A pressure of more important business, however, prevented the Eighteenth General Assembly from considering some of the matters then suggested for its attention.

I would again suggest that section 3166, Revised Statutes of Colorado, 1908, be specifically repealed. There may be some question as to whether it is not superseded by the law providing for water commissioners, but its existence on the statute books creates a wrong impression in some quarters and tends to confusion in the distribution of water.

FILING LAW

The Eighteenth General Assembly materially improved the details of the filing law in many ways. It reduced the clerical work required in this office, did away with the possibility that maps filed in this office and in the office of the county clerk might not be duplicates as required by law, removed the misleading and generally misunderstood certificate formerly required of the State Engineer's office, and increased the fees to such an extent as to greatly reduce the number of filings not made in good faith. There is, however, still one very valuable addition which could be and, in my opinion, should be made to this law. There should be some provision for the automatic expiration of claims which are not followed by active work. There are now about 17,000 filings in the State Engineer's office. Many of these make three or four claims each. It is safe to say that fully 10,000 of these filings have never been followed up by any work whatever indicating the good faith of the claimant. Their very existence, however, is a cloud upon the title of many bona fide claimants. If anyone promoting an irrigation project in good faith succeeds in interesting outside capital to such an extent that the proposed investors send an attorney to look into the legal phases of the scheme, such an attorney will find thousands of claims antedating those of the scheme under investigation and to these he will attach their face value. If he be from one of the eastern states, it is useless to argue that the claims are of no importance. He finds them on the record, they antedate the claims on which his clients are asked to invest, and to him they are clouds on the title to the water which it is proposed to acquire. Many a meritorious project has been adversely reported on grounds no more substantial than this. A stringent regulation requiring actual construction work will not deter a bona fide claimant, but, like the increase in fees, it will be one more obstacle in the way of those who would speculate in the natural resources of the State. The law should provide that at least ten per cent. of the construction work required for a development described in a filing should be done within two years, and that the work should be completed within five years. The State Engineer should be authorized and required to stamp in a plain and conspicuous manner the word "Cancelled" across the face of every map and statement in this office pertaining to a claim which does not comply with these requirements. An act of this kind will do much to facilitate the financing of meritorious irrigation projects which are promoted in good faith.

RESERVOIRS

The recommendations of the Fifteenth Biennial Report under this heading are again urged. They will, however, merely be mentioned, since the reasons for advancing them were given in the report two years ago and need not be repeated.

The latter part of Section 3202, Revised Statutes of Colorado, provides for the approval of plans for a dam exceeding ten feet in height by the county commissioners of the county in which it is to be located. This should be repealed.

The latter part of Section 3203, providing for a determination of the loss incident to running reservoir water in natural streams by the commissioners of irrigation or by the county commissioners, should be repealed.

Section 3225, which provides for the determination of the loss incurred in making exchanges between reservoirs and ditches by the State Engineer, should be extended to cover all cases in which any question of loss by running water in a public stream may arise.

It has been pointed out that there is no means for enforcing the provisions of section 3205 giving the State Engineer control over the construction of reservoirs. Most people are ready to build as they see fit and without the restrictions which may be imposed by the State Engineer's office, and then demand the protection to them afforded by the certificate of acceptance provided in the latter part of this section. In several instances in the biennial period just closed the State Engineer has been obliged to point out very emphatically, not to say forcibly, that the certificate of acceptance and the supervision of construction by this office are inseparable and that those who are so ready to avoid that portion of the law which does not suit them come with very poor grace asking the protection of that portion which they find to their advantage. It is very important that the Attorney General

be authorized, upon the complaint of the State Engineer, to institute injunction proceedings against any construction which does not comply with the provisions of section 3205. The section is an excellent one in itself but lacks the machinery for its enforcement.

Sections 3215 to 3220 inclusive, providing for the survey, construction and inspection of reservoirs under the direction of the county surveyor, should be specifically repealed.

DUTIES OF OWNERS

I again urge very strongly the desirability of requiring owners to provide and maintain permanent signs in plain view at each headgate, measuring flume and public road crossing, which signs should give the name of the ditch and the dates and amounts of all priorities decreed to it. The expense to the owner would be a mere trifle and the publicity thus created would go far towards preventing illegal diversion of water.

I further repeat here the recommendation that everyditch or reservoir inlet which is entitled to divert from a public stream twenty-five cubic feet per second or more should install an automatic self-registering gauge on its measuring flume. The gauges should be installed and maintained by the ditch owner and penalties provided for tampering with them or falsifying the records. The charts from the gauges should go immediately to the division engineer and should become a part of the records of his office. The records of these charts together with the official rating table of the ditch should be prima facie evidence as to the quantity of water being diverted; and should that quantity be in excess of the amount to which the ditch is entitled the division engineer should be required to penalize the ditch by depriving it of double the amount of water stolen. This may seem like drastic legislation but ditch managers, however honest in other respects, are notorious water thieves and the lack of adequate legislation on this point at the present time puts a very high premium on water stealing. The recommendations of the Fifteenth Biennial Report as to the installation of automatic gauges by reservoir owners and those making exchanges are fully covered by Chapter 153 of the Session Laws of 1911.

I would again point out that section 3259, which provides for the trial of water thieves before the nearest justice of the peace, is entirely inadequate. There is no provision for any prosecution. The water commissioner who may arrest a violator of the law must go himself and take his prisoner at his own expense before the justice of the peace. He must be prosecuting witness and prosecuting attorney before a judge and jury who in all probability have common cause with the prisoner. Provision should be made for action through the district attorney's office upon a complaint filed by the water commissioner and the prosecution should be in the criminal division of the district court. The present system of laws for the prevention of water stealing is about as effective as though a street should be strewn with five-dollar gold pieces and a law enacted prohibiting people from taking them but advising the public that whatever a man could get away with without being seen he was entitled to retain.

WATER COMMISSIONERS

From time immemorial the reports of the State Engineer have recommended modifications in the method of appointment and compensation of water commissioners. The local water commissioner who is not required to know of the existence of anything beyond the boundaries of his own district was all very well twenty-five years ago. To-day he is simply an obstruction in the administration of the laws on the statute books by the division engineer. The control of these appointments by the county commissioners through the law which requires the Governor to appoint from a list of persons furnished by the county commissioners, is objectionable from every standpoint of honest administration. No argument in favor of this system can be advanced except the dishonest one of determination to secure a local advantage at the expense of neighboring districts. The Governor should have as free a hand in the appointment of water commissioners as he has in the appointments to much more responsible positions. There is no reason why a Governor who is entrusted with the selection of a bank commissioner, an insurance commissioner, a railroad commissioner and a state land commissioner should not be allowed to exercise his discretion to the same extent in the selection of water commissioners.

The water commissioners should be paid monthly salaries and should be specifically under the orders of their respective division engineers. The salaries should be paid by the State and every semblance of local control should be removed. In this way only can they be made State officials in every sense of the word.

I recommend that each district water commissioner should receive a salary of one hundred and twenty-five dollars per month for not to exceed ten months in any one calendar year. I further recommend, instead of the present system of deputies, the appointment by the Governor of water commissioners at large, not to exceed eight in number for any one division and to serve for not exceeding six months in any calendar year. They should be assignable by the division engineer and should act as deputies to the various district commissioners as assigned. There are seventy water districts in the State. In twelve of these at the present time there are no water commissioners, because their services are not required. By the recommended arrangement there would, therefore, be fifty-eight district water commissioners, each receiving not to exceed $1,250 per annum. There would be not to exceed forty water commissioners at large, each receiving not more than $750 per annum. The maximum possible cost under this arrangement would be $102,500 per annum or $205,000 for the biennial period. This might be very materially reduced, within the discretion of the Governor, by not appointing the full authorized number of commissioners at large and by still further reducing the number of district water commissioners by omitting those in districts where there is very little demand for their services. In such districts water commissioners at large could perform all the duties. There are also relatively few districts in the State in which the water commissioners would have to serve for the full time of ten months each year.

DIVISION ENGINEERS

The Eighteenth General Assembly enacted a law modifying to some extent the provisions for the division engineer's office. The term of office was increased to four years and the salaries attaching to the two larger divisions (Nos. 1 and 2) were materially increased. The locations of the division engineers' offices were specified, and it was provided that the Secretary of State should supply each division engineer with suitable furniture and office equipment. This last provision was inoperative since the bill carried no appropriation by means of which the Secretary of State might perform the duty thus imposed upon him. This omission should be remedied so that these State offices may be properly equipped.

It was suggested two years ago that the requirement of examination for the establishment of an eligible list from which the division engineers should be appointed, ought to be eliminated. In view of the recent enactment of the civil service law, the provisions of which may apply to the division engineer's office, further recommendation along this line is not timely.

I would, however, again urge in this connection that the salaries of the division engineers in Divisions Nos. 3, 4 and 5 should be increased to $2,500 per annum, as provided for Divisions Nos. 1 and 2. It has been urged that the duties of the division engineers in these three divisions do not require all of their time. To this I would answer that if an official receives an inadequate salary he is pretty certain not to devote all of his time to his official duties. If his salary is made commensurate with the importance of his duties he will soon find that there is plenty of valuable work to occupy all of his time. Moreover, the importance of the divisions on the western slope is rapidly increasing and there is much which the division engineers can do in the way of collection of information which would make for the progress of that portion of the State.

STATE ENGINEER'S OFFICE

In the Fifteenth Biennial Report it was recommended that the organization of the State Engineer's office be modified to meet the increasing and somewhat changed duties of the office. It was suggested that one deputy state engineer was sufficient but that his salary should be $2,500 per annum instead of on the present per diem basis. In addition, the appointment of two assistant state engineers at salaries of $1,800 per annum, to be used in the field chiefly in the examination of reservoirs, should be authorized. An increase in the hydrographic force was recommended and some minor changes in the clerical force.

The most important of these modifications were made by the Eighteenth General Assembly. The hydrographic force, the most important part of the office, was increased as requested and the desired increase in the clerical force was authorized. The change in the arrangement of deputies was not made. This is believed to be important and is again urged. With two nominal deputies in the office, there has always been one real deputy state engineer and one who was substantially a chief clerk, whose duties might be performed by a cheaper man. It was also recommended that one clerk at $1,200 a year might be dispensed with and an office boy at not to exceed $750 per year substituted. This substitution is again urged.

Under the present filing law the office is required to furnish blue prints of all the maps filed. The amount paid for these blue prints will reach seven or eight hundred dollars per annum. In addition to this, the number of blue prints required for other purposes will increase the cost of this item to something like two thousand dollars for the biennial period, so long as the work is done on the outside. If the State Engineer's office could be equipped with an electric blue print machine and provided with an office boy as suggested, fully one-half of this amount could be saved.

Under the suggested arrangement the salary list of the State Engineer's office would be as follows:

State Engineer	$ 3,000.00
Deputy State Engineer	2,500.00
Two Assistant State Engineers at $1,800	3,600.00
Chief Hydrographer	1,800.00
Six Hydrographers at $1,500	9,000.00
One Draftsman	1,500.00
Two Stenographers at $1,200	2,400.00
File Clerk	1,200.00
Office Boy	750.00
Total	$25,750.00

At the present time the salary list is $24,100 per annum, allowing $2,000 per annum for each deputy state engineer, which is about the amount paid.

IRRIGATION DISTRICTS

Two years ago it was suggested that the organization and financing of irrigation districts should be subject to some sort of State control. The reasons for this were pointed out at that time. They still exist. In the Fifteenth Biennial Report it was suggested that the State Board of Land Commissioners would be the proper body to exercise the requisite control, since it is a constitutional board and its membership includes one engineer. The State of California after its disastrous experience in irrigation district failures has provided for supervision by a board consisting of its Attorney General, its State Superintendent of Banking and its State Engineer. Whatever board or commission be endowed with the powers of supervision and control, experience clearly indicates the necessity for something of this kind. The districts which have real merit are seriously handicapped in making financial

arrangements by the failures heretofore recorded against many in which failure was a foregone conclusion. That it is possible to organize an irrigation district along honorable lines and make such a district a success is not disputed, but the present law lends itself too readily to the furtherance of the schemes of unscrupulous promoters Furthermore, something more than supervision by a board of three directors, each of whom spends most of his time attending to his own private affairs, is demanded. If it be understood that the average irrigation district has property against which something like a million dollars of indebtedness stands, it will perhaps be realized that the management of such property cannot be entrusted to the casual attention of people who are thinking most of the time of other affairs. A bank with deposits of a million dollars receives the constant attention of its officers. A railroad with a few millions of outstanding bonds is watched in every detail by a large organization of trained men. There is no reason to suppose that an irrigation enterprise involving thousands of acres and a million or more of investment will run itself or that it can be run by untrained men or by any men who devote only a few days a month to its affairs.

There are some irrigation districts in the State which have no boards of directors for the reason that no one is qualified by residence to act as director. In some of these instances some indebtedness has been incurred and there is in all of them some business requiring attention. Authority should be given to the board of county commissioners or the State Board of Land Commissioners, or some board to be created, composed of existing State officers, to act as a board of directors in any such district until such board of directors can be legally elected or until the affairs of the district can be settled and the district itself dissolved.

IRRIGATION COURT

Two years ago the Biennial Report of the State Engineer suggested the organization of an irrigation court. The idea is, in a measure, a combination of the practice in Colorado with that in Wyoming and other neighboring states.

In Wyoming, adjudications of water rights are made by a board of control consisting of the State Engineer and the superintendents of the four water divisions in the State. This board is undoubtedly better qualified to deal with the facts upon which adjudications must be based than any court now existing. Its qualifications are due to the intimate knowledge which its members have of the distribution and use of water in the various parts of the State, and of the physical facts upon which the water supply depends. To this extent the arrangement is a good one. The organization in this State of an irrigation commission whose powers, duties and qualifications should be somewhat similar to those of the Wyoming board of control has been frequently suggested as a means of putting the adjudication of our water rights upon a somewhat more rational basis. However, the defect in the Wyoming system, and the defect which would be most prominent in the proposed irrigation commission for Colorado, is the lack of judicial authority. Dissatisfied claimants could and would appeal from the findings of the board of control to the courts, where the entire question would be threshed over a second time before a tribunal which lacked the intimate knowledge of facts possessed by the members of the board of control. In this there would be all the expense, delay and complication of the present system of adjudication by the district court in Colorado, added to the expense and time necessary properly to present matters to the board of control.

It has been frequently stated that appeals from the findings of the board of control in Wyoming are infrequent. This is, no doubt, true but the Wyoming streams have not been over-appropriated to the extent which prevails in Colorado and the competition for water is by no means so keen. It is safe to assert that when the development in Wyoming becomes something near what it is in Colorado practically every finding of the board of control will be appealed to the courts.

The underlying idea of the suggested irrigation court for Colorado is a combination of the judicial authority and legal knowledge of our district courts with, to some extent, the technical knowledge and practical familiarity with the distribution of water which is possessed by the Wyoming board of control, while at the same time creating a court which should confine its time, energy and attention to one subject and thus be able to expedite all litigation of this kind.

In the State Engineer's report it was suggested that such a court should consist of three judges, two of whom should be lawyers learned in irrigation law and one of whom should be an experienced irrigation engineer. It was contemplated that all cases of whatever nature involving the right to the use of the public waters should be considered by the full bench of this court. It has been suggested by some attorneys with whom the matter has been discussed that such a court would not be able to transact all the business which would be presented to it and that the number of judges should be increased and authority given to hear and decide cases by a division consisting of less than the full bench. This is a detail which, of course, can be worked out only by experienced lawyers and others familiar with the detail of legal procedure. It is contemplated that the court should have authority to sit any place in the State of Colorado, that it should have sole and exclusive jurisdiction of every question involving the right to use of public waters, and that appeals to the Supreme Court should lie only in certain kinds of cases and where questions of law were involved.

There seems to be no reason why a court organized in this manner should not have all the advantages which could be claimed for an irrigation commission or for the Wyoming board of control, with the additional very great advantage that its rulings and orders would have judicial authority and could not be set aside by a hastily entered order in a district court.

Naturally, the question of the expense involved in such an organization will be raised. Whatever it may be it is justified. There are perhaps two and one-half million acres of irrigated land in the State of Colorado. It is worth at a low estimate $150,000,000. All of this value is given to it by the water and it is this value which is

in need of conservation and protection, and it is this vast fortune which would be in the keeping of such a court. Economically used and carefully distributed, it is probable that there is sufficient water in the State which can be applied to land, to double the present irrigated acreage and it would be the task of the proposed irrigation court to help make this $150,000,000 into $300,000,000 in the course of the next decade. The court can be organized in such a way as to be thoroughly effective only by amendment to the constitution, since only in this way can the district court be ousted of its jurisdiction in irrigation cases, and in order to be effective the irrigation court must have sole jurisdiction in such matters.

DECREES TO WATER RIGHTS

There is a lack of uniformity and in many cases serious conflict in the water right decrees entered in the various district courts in this State. Many of them were entered at a time when neither the court nor anyone else realized what their money value would be or what fruitful sources of litigation they would prove. Many of them give the quantities of water to be diverted in units which cannot now be identified. Some of them did not specify the quantity at all.

So long as a particular decreed amount was confined to diversion at the original headgate and used on the original land there seemed to be no necessity for precision, since the quantity which could be used in this way was well understood. But with the growth of the system of changing points of diversion, the indefiniteness of such decrees became extremely troublesome. There are many instances in which ditches have sold and had transferred large quantities of water, while still retaining enough for the uses originally contemplated in the decree.

Excessive decrees and the possibility of changing points of diversion are the basis of most of the speculation in the public water supply. If an irrigation court is to be created it should be authorized and required to call in every decreed water right in the State to make a showing as to the quantity of water actually applied to beneficial use and to what extent its right has become vested. A decree should then be entered covering the quantity of water actually utilized and specifying not only the number of cubic feet per second which may be diverted, but the number of acre-feet which may be diverted in any one calendar year.

If in addition to this a law could be enacted prohibiting changes in points of diversion, much would be accomplished towards removing the speculative element in the supply of water to land.

There are approximately two and one-half million acres of irrigated land in Colorado. It is the belief of the writer that there is sufficient water and land to which it can be applied to double this irrigated acreage. The first and most important step in this direction, however, is to do away with the possibility of the "all-hog" methods which have heretofore prevailed.

WATER STORAGE

Under the law as set forth by the statutes and by various decisions of the Supreme Court, water is distributed to reservoirs in accordance with their dates of priority, exactly as it is to ditches. The result which is aimed at by this distribution is proper and there can be no justification for any change in the law which would not permit the attainment of the same result. There are, however, practical difficulties in the administration which make it desirable that a change should be made. To illustrate:

Reservoir "A" having the earliest priority may be located very low down on the stream. Reservoir "B" with a later priority but, perhaps, with very much greater capacity is located near the headwaters.

As at present administered, Reservoir "B" cannot be permitted to store water until "A" has been supplied with the full amount to which it is entitled by virtue of its decree. However, it may happen, and has happened, that by the time "A" is filled the supply available for "B" has been nearly exhausted, while there is still a large quantity of water originating below "B" which would have been available for "A" if "A" were not already full.

Under such conditions as these a great deal of water goes to waste and some reservoirs go without or remain only partially filled when they might have had a full supply.

To remedy this, it is proposed that water be stored first in the reservoirs highest up in the drainage area regardless of priority, then those next lower down, and so on. This retains all the water available for storage at the highest possible points and permits of its subsequent distribution to whatever reservoirs or ditches may be entitled to receive it.

It would be an extremely simple matter to open a ledger account with each reservoir and make the State Engineer's office a clearing house for the adjustment of these accounts.

Under the present arrangement there is a sharp rise in some tributary stream and the division engineer learns of it by wire. If he takes the time to find out the condition of all the reservoirs which might draw this water the flood is gone before he can issue any orders for its disposition. If he had the authority to order the water into the first available reservoir it would be a simple matter to put it afterwards where it belongs.

While I am without the exact figures on which to base an accurate estimate of the saving in this way, I believe I am safe in saying that the storage per annum in the Platte river drainage area and in the Arkansas valley would be increased fifty per cent. under this system of administration.

SUPERVISION OF BRIDGE CONSTRUCTION

Two years ago a bill was introduced into the legislature prohibiting the construction of any bridge on a public highway until the plans and specifications had been examined and approved by the State Highway Commission.

No argument in favor of such supervision seems necessary. It is in line with the existing law which provides for the supervision of the construction of dams by the State Engineer. This bill, or a similar one, should be again introduced and its passage urged.

INTERNAL IMPROVEMENT FUND

There is some doubt as to whether this is a proper subject for discussion in the State Engineer's report at this time. Two years ago it was recommended that this fund should be administered by the Highway Commission, instead of being appropriated in a large number of small amounts as has heretofore been the practice. A bill making the transfer to the Highway Commission was acted upon by the Eighteenth General Assembly and it was generally thought that the bill had become a law. However, some defect was found in the procedure and the Supreme Court held that the bill had not been passed. A similar bill was initiated during the year 1912 and defeated at the general election on November 5th. In the light of these facts it seems to me useless to urge again that the internal improvement fund be placed at the disposal of the Highway Commission. Nevertheless, every reason for such a step which existed two years ago exists today with even greater force. It seems probable that the money can be used in places where it is most in demand and with greater economy by a commission having the powers and facilities of the Highway Commission, than by creating a large number of boards of construction each of which is authorized to spend a few hundred or a few thousand dollars.

REGULATING THE PRACTICE OF ENGINEERING

It seems high time that the practice of the engineering profession should be limited to those having at least a certain minimum of training for the work. This is done in the professions of law and medicine and no one can be found to-day to contend seriously that such regulation is not for the general good. The engineering profession is one requiring as broad a foundation and as much special training as either law or medicine, and the damage which can be done by an incompetent and untrained person is incalculable.

Within the past four years a number of large and important reservoirs have failed with disastrous consequences to neighboring property, though, by the rarest good fortune, without loss of life. I do not hesitate to say that these failures were directly due to ignorance of the most fundamental principles of engineering design and construction upon the part of the designers and builders. This is the most charitable possible view, for if they were competent their conduct in erecting such structures was nothing less than criminal.

A bill was introduced in the Eighteenth General Assembly providing for the licensing of practicing engineers by a board to be created for that purpose. This board was to consist of seven members, six of whom should be appointed by the Governor to membership on the board and the seventh to be the State Engineer ex officio. It was provided that the members of this board with the exception of the State Engineer should serve for six years, two being appointed by each Governor. The members of the board were to serve without compensation and no expenditure of funds other than the license fees collected was authorized. The bill provided for holding examinations and taking such other steps as might be necessary to determine the qualifications of applicants. It provided further for the cancellation of licenses in case of improper business or professional conduct on the part of the holders. No annual license fee was provided or intended, it being merely the intention of the bill that the applicant should pay such a fee at the time of his original application as would meet the ordinary clerical expenses of examination and certification.

The bill was not acted upon by the legislature, chiefly, I think, because it was crowded out of consideration by the pressure of more important business. It has been the subject of much discussion among engineers and others for the two years which have elapsed since that time, and in the light of all this discussion it still appears to be a desirable piece of legislation.

A physician who is incompetent may cause the premature death of one or more persons, but an engineer who is incompetent may be directly responsible for the death of many hundreds at one time. An incompetent or irresponsible attorney may bring about a confusion in property rights which can with difficulty, if ever, be straightened out. An incompetent engineer may cause the absolute destruction of many hundreds of thousands of dollars worth of material property. This is what actually happened in the failures of some of the reservoir dams above referred to. No reason appears, therefore, why if the physician and the lawyer should be licensed and their practice subject to regulation by law, the engineer should not be treated likewise and the public protected from incompetence and, as far as possible, from dishonesty in the practice of this profession. The reintroduction and passage of this bill are strongly urged.

WATER POWER DEVELOPMENT

On this subject I have nothing definite to offer except the conviction that some action of the legislature is necessary to encourage the development of water power and to protect those who invest their capital in this kind of enterprise.

As is shown in a subsequent chapter, the total water power developed in the State is less than 75,000 horse power. Of this more than half is in the plants of The Central Colorado Power Company, and these have been developed within the past four years. The consumption of power in the City of Denver alone exceeds 25,000 horse power. It is nothing short of ridiculous that the total water power development in the State is so small. The Federal government, or certain bureaus of it, has thrown every possible obstacle in the way of water power development by imposing such restrictions in its grants of rights of way that no reasonable business man will think of investing in water power enterprises. The right of the federal bureaus to take such action must at some time and in some way be tested in the United States courts. It is not clear how this can be done unless it can be brought about by some

act of the legislature. The difficult questions involved here are legal and I am not competent to discuss them or to offer suggestions.

I wish, however, to impress the fact that in a state where the topographical relief is so great, where the quantity of water originating in the mountains is so enormous, and where the facilities for power development are second only to those in the Alps, the water power development amounts to less than one horse power for each ten people in the State. This fact alone should be sufficient to prompt our lawmakers to an investigation as to the causes.

CHAPTER III.

FINANCIAL

The Eighteenth General Assembly made appropriations for the State Engineer's office as follows:

State Engineer, salary	$ 6,000.00
Two Deputies, State Engineer, salary and expenses	9,000.00
Draftsman, salary	3,000.00
Chief Hydrographer, salary	3,600.00
Six Hydrographers, salaries at $125 per month	14,100.00
Hydrographers, expenses	7,125.00
Two Stenographers, salaries at $100 per month	4,200.00
File Clerk, salary	2,400.00
Clerk, salary	1,800.00
Incidental expenses	3,100.00
Irrigation Division Engineers:	
Division No. 1, salary	3,000.00
Division No. 2, salary	3,000.00
Division No. 3, salary	3,000.00
Division No. 4, salary	3,000.00
Division No. 5, salary	3,000.00
Division Engineers, expenses	5,000.00
Total	$74,325.00

From these funds balances were turned back to the general fund as follows:

Deputies, salaries and expenses	$ 67.31
Draftsman, salary	137.50
Chief Hydrographer, salary	275.00
Hydrographers, salaries	695.83
Hydrographers, expenses	849.94
File Clerk, salary	91.68
Clerk, salary	600.00
Incidental expenses	2.58
Division Engineers, expenses	1,060.11
Total	$3,779.95

This leaves the amount expended for the administration of the State Engineer's office and for the service of water distribution in the State exclusive of water commissioners' salaries, $70,545.05. In addition to this there was expended from the gauging fund provided for by Section 3333, Revised Statutes of Colorado, 1908, $7,055.03. The total expended by the office was, therefore, $77,600.08.

As a credit against this, the office has received and transmitted to the State Treasurer $24,106.57. The balance in the gauging fund, which was $11,580.48, was transferred to the general fund on December 1st, 1911, and since that date all receipts in the State Engineer's office have been turned in to the general fund. The net cost of operation of the office has therefore been $53,493.51.

By way of comparison with the preceding biennial period the following figures are reproduced from the Fifteenth Biennial Report of this office:

Appropriated by the Seventeenth General Assembly	$46,600.00
Turned back into the General Fund	2,650.37
Leaving amount expended	$43,949.63
Expended from Hydrographic Survey Fund	9,544.60
Expended from Gauging Fund	10,540.88
Total	$64,035.11
As a credit against this the fees received for the biennial period were	14,493.27
Leaving the net cost of operating the office	$49,541.84

The net increased cost to the State in the operation of the State Engineer's office for the biennial period 1911-12 as compared with that immediately preceding is, therefore, $3,951.67. This small increase in cost has permitted some necessary increases in the clerical force of the office and the organization of what is believed to be the most efficient and capable hydrographic service maintained by any state. The salaries paid are moderate but are sufficient to attract competent hydrographers and to retain them for such long periods of time that the State derives a great benefit from their services.

By an act of the Eighteenth General Assembly the fees payable to the State Engineer's office were substantially increased, with the result that notwithstanding a general depression in the promotion of new irrigation enterprises, the fees received during the biennial period 1911-12 amounted to $24,106.57 as against $14,493.27 for the biennial period immediately preceding.

As it seems probable that the issuance of free transportation to State officers by the railroads will be discontinued either because of the enactment of a new law or because of a change in the policy of the railroad companies, there must be an increase in the expense appropriations for the succeeding two years.

During 1911 the railroads issued forty-seven annual passes and 153 trip passes to State employees and hydrographers of the United States Geological Survey travelling on the business of this office. During 1912 the office received thirty-nine annual passes and seventy-four trip passes. Of the 153 trip passes issued in 1911, sixty-eight were for hydrographers of the United States Geological Survey and eighty-five for State employees. In 1912, thirty-one were issued for United States Geological Survey hydrographers and forty-three for employees of the State.

The cash value at prevailing rates of the transportation covered by the trip passes issued during the biennial period was $2,155.50, and the total number of miles travelled was 67,436. This is an average rate of 3.20 cents per mile. During 1912 a record was kept of the mileage travelled on annual passes exclusive of those issued to water commissioners. This mileage was 38,637, of which 35,937 was over roads where the average rate of 3.20 cents per mile may fairly apply and 2,700 miles was over roads where the prevailing rate is six cents per mile. The cash value of this transportation was, therefore, $1,312.00. Assuming the same mileage for 1911, the annual passes issued to this office were equivalent to $2,624.00. Adding this to the value of the trip passes issued gives a total of $4,779.50 for the value of free railroad transportation received by this office during the biennial period.

A record of the mileage travelled by the water commissioners was not obtainable and no estimate of the value of this can be made. This record represents a certain cash value to the railroad companies but does not represent a necessary outlay by the State, since water commissioners' expenses under the present law must be paid by their counties, if at all.

As there was some travelling on annual passes, of which no record was made at the time, it is safe to say that the cost of railroad fare for necessary travelling by employees of the State Engineer's office will be $5,000 in two years. Of this, by far the larger part has been and will be expended by the hydrographers.

Following is a detailed statement in tabular form of receipts and expenditures to and from each of the various funds handled through this office. The financial statements relating to the various road and bridge funds expended through this office will be found in a subsequent chapter.

STATE ENGINEER'S SALARY FUND

Appropriated		$6,000.00
Charles W. Comstock	$6,000.00	
	$6,000.00	$6,000.00

DEPUTIES, STATE ENGINEER—SALARIES AND EXPENSES

Appropriated		$9,000.00
A. F. Hewitt, salary	$4,224.00	
A. F. Hewitt, expenses	223.95	
J. W. Johnson, salary	4,164.00	
J. W. Johnson, expenses	245.05	
C. W. Comstock, expenses	67.34	
O. L. Nelson, expenses	8.35	
Balance	67.31	
	$9,000.00	$9,000.00

DRAFTSMAN'S SALARY FUND

Appropriated		$3,000.00
O. L. Nelson	$2,862.50	
Balance	137.50	
	$3,000.00	$3,000.00

CHIEF HYDROGRAPHER'S SALARY FUND

Appropriated		$3,600.00
Thomas Grieve, Jr.	$3,325.00	
Balance	275.00	
	$3,600.00	$3,600.00

HYDROGRAPHERS' SALARY FUND

Appropriated		$14,100.00
Delos L. Bundy	$2,104.17	
M. E. Bunger	2,112.50	
C. L. Chatfield	2,312.50	
B. S. Clayton	2,312.50	
C. C. Hezmalhalch	2,250.00	
C. E. Turner	2,312.50	
Balance	695.83	
	$14,100.00	$14,100.00

STENOGRAPHER'S SALARY FUND

Appropriated		$2,400.00
N. F. Edginton	$ 650.00	
Marie Callaghan	36.67	
Mary W. Dargin	1,713.33	
	$2,400.00	$2,400.00

STENOGRAPHER'S SALARY FUND

Appropriated		$1,800.00
L. D. Smith	$1,800.00	
	$1,800.00	$1,800.00

FILE CLERK'S SALARY FUND

Appropriated		$2,400.00
E. H. Rhodes	$ 508.32	
J. H. Bradley	1,800.00	
Balance	91.68	
	$2,400.00	$2,400.00

CLERK'S SALARY FUND

Appropriated		$2,400.00
E. H. Rhodes	$1,800.00	
Balance	600.00	
	$2,400.00	$2,400.00

HYDROGRAPHERS' EXPENSE FUND

Appropriated		$7,125.00
Delos L. Bundy, expenses	$ 166.90	
M. E. Bunger, expenses	334.80	
C. L. Chatfield, expenses	1,009.29	
B. S. Clayton, expenses	1,308.95	
E. O. Christiansen (U. S. G. S.), expenses	7.50	
Fletcher, R. H. (U. S. G. S.), expenses	37.95	
W. B. Freeman (U. S. G. S.), expenses	22.40	
Glenn A. Gray (U. S. G. S.), expenses	8.20	
Thomas Grieve, Jr., expenses	453.95	
C. C. Hezmalhalch, expenses	595.15	
G. H. Russell (U. S. G. S.), expenses	115.75	
C. E. Turner, expenses	745.95	
R. C. Miles (U. S. G. S.), expenses	14.90	
H. B. Waha (U. S. G. S.), expenses	6.65	
C. L. Chatfield, livery	561.15	
B. S. Clayton, livery	10.00	
Delos L. Bundy, livery	98.00	
M. E. Bunger, livery	181.50	
C. C. Hesmalhalch, livery	15.00	
C. E. Turner, livery	353.00	
A. F. Hewitt, livery	140.00	
Lewis Jewelers' Supply Co	5.00	
A. E. Johnson Machine Co	1.15	
R. E. Reiche, repairing stop watches	9.00	
George Tritch Hardware Co	18.50	
Peter Farrell, cable station, Maybell	18.05	
Frank B. Bower, lumber for gauge	2.62	
Gibson Lumber & Coal Co	29.90	
A. E. Meek Trunk & Bag Co	3.85	
Balance	849.94	
	$7,125.00	$7.125.00

INCIDENTAL EXPENSE FUND

Appropriated		$3,100.00
Salaries, gauge readers, 63 stations	$2,902.15	
Publishing notice of division engineers' examination, Division No. 1	14.19	
Publishing notice of division engineers' examination, Division No. 2	9.33	
Publishing notice of division engineers' examination, Division No. 3	3.60	
Publishing notice of division engineers' examination, Division No. 4	16.66	
Publishing notice of division engineers' examination, Division No. 5	12.34	
Denver Photo Materials Co	36.07	
Frank Hinman, Fort Collins cable station	43.33	
Wm. Ainsworth & Sons, repairing transit	15.00	
A. W. Ainsworth, repair to water gauge	9.00	
Denver Camera Exchange	8.05	
H. C. Rogers, installing automatic register	4.85	
Cardwell Blue Print and Supply Co	6.62	
Carstarphen Electric Co	3.95	
A. E. Johnson Machine Co	3.20	
Colorado Photo Supply House	2.88	
Denver Dry Goods Co	2.60	
A. S. Carter	2.10	
Smith-Premier Typewriter Co	0.75	
F. Winkler, repairing safe	0.75	
Balance	2.58	
	$3,100.00	$3,100.00

DIVISION ENGINEER'S SALARY—DIVISION NO. 1

Appropriated		$3,000.00
Fillmore Cogswell	$3,000.00	
	$3,000.00	$3,000.00

DIVISION ENGINEER'S SALARY—DIVISION NO. 2

Appropriated		$3,000.00
E. R. Chew	$3,000.00	
	$3,000.00	$3,000.00

DIVISION ENGINEER'S SALARY—DIVISION NO. 3

Appropriated		$3,000.00
F. W. Swanson	$3,000.00	
	$3,000.00	$3,000.00

DIVISION ENGINEER'S SALARY—DIVISION NO. 4

Appropriated		$3,000.00
A. H. Stokes	$ 713.73	
Heman C. Getty	2,286.27	
	$3,000.00	$3,000.00

DIVISION ENGINEER'S SALARY—DIVISION NO. 5

Appropriated		$3,000.00
Theodore Rosenberg	$3,000.00	
	$3,000.00	$3,000.00

DIVISION ENGINEERS' EXPENSE

Appropriated		$5,000.00
Fillmore Cogswell, Division No. 1	$ 882.10	
Williamson-Haffner Engraving Co., Division No. 1	117.65	
E. R. Chew, Division No. 2	488.38	
T. and H. Pueblo Building Co., office rent, Division No. 2	322.00	
Mountain States Telephone & Telegraph Co., Division No. 2	269.75	
Franklin Press, Division No. 2	27.50	
F. W. Swanson, Division No. 3	439.56	
Cardwell Blue Print & Supply Co., current meter for Division No. 3	70.00	
A. H. Stokes, Division No. 4	33.85	
Heman C. Getty, Division No. 4	541.80	
Cardwell Blue Print & Supply Co., current meter for Division No. 4	70.00	
Theodore Rosenberg, Division No. 5	677.30	
Balance	1,060.11	
	$5,000.00	$5,000.00

GAUGING FUND

Balance in fund, December 1, 1910		$ 7,986.85
Office receipts, December 1, 1910, to November 30, 1911, inclusive		10,648.66
William Ainsworth & Sons	$ 2.25	
Arkansas Valley Ditch Association	2.00	
C. W. Beach	0.75	
J. H. Bradley, salary	150.00	
Bristol Company, automatic gauge charts	10.49	
F. O. Browne, tower for cable station	80.30	
Delos L. Bundy, salary	505.00	
Cardwell Blue Print & Supply Co.	165.71	
Carstarphen Electric Co.	5.58	
C. L. Chatfield, expenses	237.02	
C. L. Chatfield, salary	550.00	
E. O. Christiansen (U. S. G. S.) expenses	18.00	
City of Las Animas	3.17	
B. S. Clayton, expenses	219.10	
B. S. Clayton, salary	495.00	
C. E. Copeland, salary	109.67	
F. M. Davis Iron Works Co., car for cable station	15.00	
R. H. Fletcher, (U. S. G. S.) expenses	52.80	
W. B. Freeman (U. S. G. S.) expenses	9.10	

GAUGING FUND—Continued

Fort Lyon Canal Co., cable station	22.96	
Gardner Lumber Co.	10.38	
Thomas Grieve, Jr., expenses	140.80	
A. E. Hemphill, salary	275.33	
C. J. Hendershot, housing for gauge	12.75	
C. C. Hemalhalch, expenses	15.10	
C. C. Hezmalhalch, salary	126.00	
W. J. Hulings, salary	51.00	
A. E. Johnson Machine Co.	30.20	
Kauffman-Callahan Novelty Co.	5.75	
Lewis Jeweler's Supply Co.	2.50	
Livery, hydrographers	145.50	
Marshall Bros.	2.65	
Amy MacDonald, salary	70.00	
Caleb Odell, salary	270.97	
W. F. Plambeck Jewelry Co.	3.50	
D. P. Rae, salary	315.00	
G. H. Russell, expenses	106.45	
Smith-Premier Typewriter Co.	5.00	
A. H. Smith, salary	385.00	
L. D. Smith, salary	450.82	
Stearns-Roger Mfg. Co.	6.51	
M. M. Stuart, salary	385.00	
George Tritch Hardware Co.	3.80	
C. E. Turner, salary	450.00	
C. E. Turner, expenses	104.40	
Tysen Bros.	1.73	
A. A. Weiland	2.30	
E. M. Williams, salary	385.00	
Gauge readers, salaries	638.19	
Balance transferred to general fund, December 1, 1911	11,580.48	
	$18,635.51	$18,635.51

DISTRIBUTION OF FEES RECEIVED IN STATE ENGINEER'S OFFICE, DECEMBER 1, 1910, TO NOVEMBER 30, 1912, INCLUSIVE

Filing claims to water rights		$18,649.00
Rating ditches		646.51
Postage		86 96
Blue prints		1,059.80
Certificates and certifications		1,188.00
Sale of "Irrigation Law"		175.00
Office labor		425.90
Examination of reservoir plans		1,786.00
Sale of padlocks		26.40
Filing of transfer decrees		63.00
Remitted to State Treasurer	$24,106.57	$24,106.57

Chapter 128, Session Laws of 1903, which is in part amended by Chapter 212, Session Laws of 1911, provides for the creation of a gauging fund from the fees paid into the State Engineer's office, which fund is to be expended for purposes set forth in these acts. The General Appropriation Bill enacted by the Eighteenth General Assembly contained a provision requiring these fees to be turned into the general fund and used so far as they would go for the purposes specified in the appropriation bill.

On December 1, 1911, the Auditor of State and the Treasurer of State transferred the balance remaining in the gauging fund to the general fund and have since entered all remittances from this office in the general fund. As a matter of general policy, this is a much more satisfactory and businesslike way of handling the finances of the State than for each office to create a fund of its own to be expended more or less at the discretion of the head of the office and under the provisions of a general statute only. There is some question, however, as to whether a mere provision in the General Appropriation Bill which conflicts with a general statute is effective and it is, therefore, possible that the question of the validity of this transfer to the general fund may be raised some time in the future, at which time it would be found that the gauging fund, if it is held still to exist, is very large. At the present moment this gauging fund would amount to $25,038.39. At the end of another biennial period it will undoubtedly exceed $50,000. Should the question then be raised and should the court hold that this amount was available for expenditure under the provisions of the acts of 1903 and 1911 above cited, there would be an amount of money available for the use of the State Engineer's office which would not only probably not be necessary in addition to the regular appropriations, but which ought not to be available for expenditure except under legislative direction.

I, therefore, recommend that the existing statutes relating to a gauging fund and its expenditure be specifically repealed, and that the provisions of that portion of the general appropriation bill of 1911 above referred to be given the full force of a general statute so that no question may arise in the future.

CHAPTER IV.

CLAIMS FOR APPROPRIATION OF WATER

During the biennial period there have been filed in this office 1,820 maps with the accompanying statements, claiming water for 1,658 ditches and for 763 reservoirs. The total quantity claimed for ditches is 135,158.19 cubic feet per second. If this quantity of water should run continuously for one hundred days it would be equivalent to a run-off of five inches over the entire area of the State. This is somewhat less than one-half the amount claimed during the preceding biennial period, but it is still preposterously large. The total amount claimed for reservoirs is 2,910,650 acre-feet. This is equivalent to a run-off of about one-half inch on the entire area of the State and is rather less than one-seventh of the amount claimed for reservoir purposes during the preceding biennial period.

The estimated cost of construction of the ditches for which claims have been filed during 1911 and 1912 is $40,669,847 and the estimated cost of reservoirs is $23,431,052. These estimates are as stated on the maps filed. In most cases the estimates thus given are too low.

The following tables show for each water district, for each irrigation division and for the entire State, the number of claims filed for ditches and reservoirs, the amount of water claimed for them and the estimated cost of construction:

DIVISION NO. I

District Number	No. of Ditches	Total Amount Claimed for Ditches, Cubic Feet Per Second	No. of Reservoirs	Total Amount Claimed for Reservoirs, Cubic Feet	Estimated Cost of Construction of Ditches	Estimated Cost of Construction of Reservoirs
1	87	9,318.71	53	3,545,009,469	$ 926,920.00	$ 844,947.00
2	29	1,241.14	11	371,974,743	41,968.00	160,114.00
3	27	1,277.13	28	6,259,299,525	727,275.00	1,764,579.00
4	15	367.21	11	197,828,983	21,450.00	96,300.00
5	20	1,796.89	24	1,049,429,378	2,747,084.00	727,093.00
6	25	297.96	6	178,693,044	165,783.00	64,000.00
7	26	184.64	16	965,292,591	49,723.00	360,200.00
8	32	445.85	17	81,584,193	729,450.00	11,750.00
9	5	19.61	1	5,224,100	1,500.00	1,000.00
23	10	119.19	2	7,187,092,419	23,300.00	100,250.00
46	19	242.39	3	51,739,782	20,250.00	8,500.00
47	28	2,927.93	8	908,925,085	633,000.00	78,000.00
48	9	2,025.25	7	5,100,382,009	37,750.00	578,925.00
64	13	2,393.64	6	1,678,260,300	186,310.00	478,465.00
65	4	127.59	2	8,745,315	23,100.00	2,500.00
Total	349	22,787.13	195	27,589,480,936	$6,334,863.00	$5,276,623.00

DIVISION NO. II

District Number	No. of Ditches	Total Amount Claimed for Ditches, Cubic Feet Per Second	No. of Reservoirs	Total Amount Claimed for Reservoirs, Cubic Feet	Estimated Cost of Construction of Ditches	Estimated Cost of Construction of Reservoirs
10	38	2,659.48	12	61,385,071	$ 311,410.00	$ 108,150.00
11	14	209.08	7	906,388,877	107,925.00	240,350.00
12	19	143.93	11	1,326,594,767	77,370.00	962,170.00
13	13	165.78	6	204,652,297	161,800.00	269,000.00
14	40	9,744.44	36	15,667,139,528	651,020.00	5,291,894.00
15	12	306.76	8	2,671,283,576	98,680.00	326,216.00
16	53	10,031.77	39	4,170,566,584	180,325.00	405,191.00
17	65	38,759.98	46	24,384,163,045	2,443,283.00	1,972,700.00
18	14	7,210.10	7	6,794,466,601	247,800.00	1,242,500.00
19	41	6,591.54	9	2,211,454,870	355,062.00	489,109.00
49	3	115.78	0	0	7,190.00	0
66	4	63.45	0	0	1,965.00	0
67	49	4,987.05	18	7,664,591,237	709,530.00	751,800.00
Total	365	80,989.14	199	66,062,686,453	$5,353,360.00	$12,059,080.00

DIVISION NO. III

District Number	No. of Ditches	Total Amount Claimed for Ditches, Cubic Feet Per Second	No. of Reservoirs	Total Amount Claimed for Reservoirs, Cubic Feet	Estimated Cost of Construction of Ditches	Estimated Cost of Construction of Reservoirs
20	39	387.53	11	7,191,216,846	$ 23,388.00	$ 763,582.00
21	3	368.70	1	6,215,800	76,300.00	500.00
22	17	575.21	1	410,699	29,401.00	90,000.00
24	2	211.00	4	217,965,513	55,000.00	117,711.00
25	16	992.96	13	14,468,716	182,890.00	12,375.00
26	13	44.35	0	0	1,930.00	0
27	6	342.01	1	233,769,222	61,400.00	50,000.00
35	37	759.96	4	977,240,000	294,125.00	347,000.00
Total	133	3,681.72	36	8,641,286,766	$ 724,434.00	$1,381,168.00

DIVISION NO. IV

District Number	No. of Ditches	Total Amount Claimed for Ditches, Cubic Feet Per Second	No. of Reservoirs	Total Amount Claimed for Reservoirs, Cubic Feet	Estimated Cost of Construction of Ditches	Estimated Cost of Construction of Reservoirs
28	11	238.88	1	24,203,951	$ 34,765.00	$ 30,000.00
29	8	127.00	2	105,954,149	54,735.00	21,500.00
30	22	2,353.27	2	288,227,809	6,621,180.00	243,500.00
31	12	372.67	0	0	237,750.00	0
32	19	164.60	12	156,711,053	23,510.00	68,000.00
33	15	103.00	3	32,203,100	13,860.00	37,000.00
34	17	82.75	6	52,184,016	6,955.00	36,690.00
40	112	1,127.47	93	809,381,680	189,893.00	301,193.00
41	25	2,139.92	6	14,597,941	9,033,705.00	5,000.00
42	91	5,689.40	42	1,290,242,778	7,150,266.00	367,965.00
59	19	341.66	1	659,300	10,125.00	1,000.00
60	67	1,185.23	8	1,896,439,488	321,691.00	450,400.00
61	28	477.44	2	46,730,164	37,120.00	2,800.00
62	7	59.93	1	10,797,861	2,900.00	18,000.00
63	17	158.18	1	32,497,500	17,535.00	8,000.00
68	12	104.00	13	516,750,789	16,300.00	103,250.00
69	8	292.81	5	862,803,113	71,627.00	255,120.00
Total	490	15,018.21	198	6,140,384,692	$23,843,917.00	$1,949,428.00

DIVISION NO. V

District Number	No. of Ditches	Total Amount Claimed for Ditches, Cubic Feet Per Second	No. of Reservoirs	Total Amount Claimed for Reservoirs, Cubic Feet	Estimated Cost of Construction of Ditches	Estimated Cost of Construction of Reservoirs
36	16	239.45	4	21,544,106	$ 120,375.00	$ 8,000.00
37	7	70.76	0	0	10,600.00	0
38	25	384.10	4	532,400,462	64,020.00	93,950.00
39	38	1,485.91	8	698,386,089	399,206.00	517,900.00
43	32	1,306.97	15	108,328,842	19,195.00	60,225.00
44	33	225.68	17	692,676,415	597,275.00	262,710.00
45	19	3,184.25	16	175,851,698	225,776.00	73,970.00
50	10	58.75	7	162,737,666	4,110.00	29,900.00
51	9	191.91	1	2,266,000	54,360.00	800.00
52	3	193.68	1	178,173,236	131,285.00	12,750.00
53	2	15.93	4	13,159,139	1,200.00	5,450.00
54	9	4,340.95	3	6,698,347,745	2,598,900.00	501,000.00
55	13	70.80	1	13,677,840	5,050.00	10,400.00
56	2	2.00	0	0	100.00	0
57	40	371.68	20	8,478,065,402	18,283.00	1,083,348.00
58	52	568.11	32	169,187,499	158,198.00	37,850.00
70	11	71.06	2	171,528,553	5,340.00	66,500.00
Total	321	12,681.99	135	18,116,300,692	$4,413,273.00	$2,764,753.00

SUMMARY

Division Number	No. of Ditches	Total Amount Claimed for Ditches, Cubic Feet Per Second	No. of Reservoirs	Total Amount Claimed for Reservoirs, Cubic Feet	Estimated Cost of Construction of Ditches	Estimated Cost of Construction of Reservoirs
I	349	22,787.13	195	27,589,480,936	$ 6,334,863.00	$ 5,276,623.00
II	365	80,989.14	199	66,062,686,453	5,353,360.00	12,059,080.00
III	133	3,681.72	36	8,641,286,766	724,434.00	1,381,168.00
IV	490	15,018.21	198	6,140,384,692	23,843,917.00	1,949,428.00
V	321	12,681.89	135	18,116,300,692	4,413,273.00	2,764,753.00
Total	1,658	135,158.19	763	126,550,139,539	$40,669,847.00	$23,431,052.00

CHAPTER V.

REPORTS OF DIVISION ENGINEERS

BIENNIAL REPORT OF IRRIGATION DIVISION ENGINEER, DIVISION NO. 1, FOR 1911-1912

Denver, Colorado, November 30, 1912.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit a report of the work of Irrigation Division No. 1, covering the biennial period of 1911 and 1912.

The year 1911 was the driest year that Colorado has experienced since the establishment of the local Weather Bureau. The total precipitation was only 7.75 inches. This was four inches less than in 1910.

The only noteworthy event of 1911, relative to the distribution of water, was the following decision of the District Court of Larimer county, and the supersedeas issued by the Supreme Court in the same case.

On March 24, 1911, an injunction decree was entered in the case of the "Larimer & Weld Reservoir Company," Plaintiff vs. The irrigation officials and the ditch owners in Districts Nos. 1 and 64. The basis of this case was an order issued by the Division Engineer on September 1, 1910, to the water commissioner of District No. 3, not to allow storage in reservoirs when the water was needed by the ditches in Districts Nos. 1 and 64, for direct and immediate irrigation. The order was issued in compliance with the law of 1901, which states that "The owners or possessors of reservoirs shall not have the right to impound any water whatever in such reservoir during the time that such water is required in ditches for direct irrigation or for reservoirs holding senior rights." This was the law of the State at that time, and the irrigation officials were compelled to obey its mandate.

The decree states:

> "That the term direct and immediate use of water for irrigation, should be defined to mean an application of water to the soil for the purpose of maturing a then growing crop, or the preservation of a perennial crop or crop to be planted in the fall and mature the following year, and the same is hereby so defined."
>
> "That that portion of each year when water is not required for immediate use for irrigation as above defined, these reservoirs are entitled to store the waters of the streams in accordance with their priority of appropriation for reservoir puposes, which the Court defines in this case, to be from the first day of October of each year, until the 15th day of April of the following year."

The irrigation officials were ordered to distribute the water in conformity with the above findings.

An appeal was taken from this decree to the Supreme Court.

On September 17, 1911, a supersedeas was entered by the Supreme Court, and the irrigation officials were ordered to "distribute the water in the several water districts involved within their respective jurisdictions, among those entitled to the decreed priorities for irrigation, domestic and reservoir purposes, in accordance with the dates of such priorities and the needs of the parties for whose benefit such priorities were decreed, to the extent that the water flowing in the streams from which such priorities are to be supplied will permit."

In the meantime the obnoxious, if not unconstitutional sentence of the law of 1901, had been repealed by the legislature. The above supersedeas of the Supreme Court is therefore the law at the present time under which water in this division is distributed. It also upholds Section C, Article XVI of the Colorado Constitution, which provides that the right to divert water for a beneficial use shall be determined by priority of appropriation.

The above order and the resultant litigation were gleefully filed upon by certain ditch and reservoir companies, as a never ending source of supply for the verbal bouquets that have been showered upon the irrigation officials during the past two years, thereby adding much to the "Gaiety of Nations."

While the statutes of the State may seem a trifle to the somewhat excited irrigation companies, it is still well to give them a certain measure of observance.

It is not nice, nor is it fair, to question the good faith of the irrigation officials in their official capacity, unless you are prepared to prove the truth of your statements. It may lead one into the use of language that can hardly be called complimentary.

"There should always be some foundation of fact for the most airy fabric, and pure invention is but the talent of a liar."

1912

The year 1912 will go on record as the wettest that Colorado has known during the past forty years. The season opened with a more than average supply of snow in the mountains, and there have been numerous rains during the season. The melting of the snow was comparatively slow, and the rains for the most part were uniformly distributed over the division. There have been no extreme high waters nor excessive floods during the year.

The total precipitation since January 1 is 18.50 inches or more than five inches above normal. It is reported that there have been only five Junes during the past forty years that have been wetter than last June. I am, therefore, pleased to report that there has been a more than normal supply of water for direct irrigation and storage in reservoirs during the past season. There has been some water stored each month and on November 30 there were 566,000 acre-feet stored in the reservoirs of this division.

Notwithstanding the above excess in the water supply during 1912, on November 1 there was a shortage of 200,000 acre-feet for the first filling during 1912 of undecreed reservoirs taking water directly from the South Platte river. This includes the shortage in Antero reservoir, which has been able to store only 40,000 acre-feet during 1911 and 1912.

On July 14, 1912, occurred the Cherry creek flood which, in Denver, is considered as second only to the flood of Holy Writ. This flood was of short duration, with a maximum flow of 11,000 second-feet between 9:30 and 11:30 p. m., and was easily taken care of by the ditches and reservoirs in Districts Nos. 2 and 1. During June and July there was a shortage of water to supply the demands of ditches and reservoirs in Districts Nos. 1 and 64, and during the two months prior to July 29, the South Platte river was dry below the headgate of the Peterson canal at Sedgwick.

On July 26 I found only fourteen second-feet in the South Platte river at Julesburg and no storage of water in Districts Nos. 1 and 64.

On August 1 there was a flood in Pawnee creek, which washed out the embankment of the inlet ditch of the North Sterling Irrigation District. At the same time there were heavy rains below Sterling and there was no demand for water for irrigation in that part of District No. 64. As a result of this sudden stopping of irrigation, the Pawnee flood and the breaking of the North Sterling ditch, all the water in the South Platte river below District No. 1, flowed through Julesburg into Nebraska during the first few days in August. This loss of water to the State cannot be guarded against, unless when water has been delivered to Districts Nos. 1 and 64 to supply previous demands, the ditches and reservoirs are prepared to take it up and put it to a beneficial use.

Contrary to the general opinion, we believe that if all the reservoirs in District No. 1 had at all times during 1912 been prepared to store water, none of the water in the South Platte river, originating above the dam of the Prewitt reservoir, would have passed out of the State.

Owing to heavy rains, there was very little irrigation from August 1 to 20 in District No. 64, and on September 16 it ceased for the season.

For more than twenty years there has been more or less friction between the ditch owners along the South Platte river below Platte Canon and the ditch owners up in the South Park, or District No. 23, the latter refusing to obey the orders issued by the irrigation officials to close down the junior ditches in order to supply the demands of senior ditches in the lower valley. The South Park people contended that as their ditches were short and seldom extended more than a mile away from the river, the irrigation of their grass lands did not materially affect the flow of the water to the valley nor to any great extent retard it. These conflicting interests finally met in court in 1911.

On February 7, 1912, an injunction decree in this case was entered in the District Court of Denver. The decree directed the irrigation officials to distribute the water in accordance with the decreed priorities and the dates of the several appropriations in the division. The ditch owners in South Park were commanded to obey the lawful orders of the irrigation officials and were enjoined from interfering with them in the distribution of the water.

An appeal was taken from this decree to the Supreme Court.

On June 22 the North Sterling Irrigation District made the claim that the Julesburg reservoir in District No. 64 and Jackson Lake in District No. 1, had their full storage rights for this year, as both of these reservoirs had been full *once* since January 1, 1912.

I ordered the water commissioners of Districts Nos. 1 and 64 *not* to allow a second filling of the Julesburg and Jackson Lake reservoirs if the water was needed for the first filling of a junior reservoir during 1912. This order is still in force in those districts.

On September 17 an order was sent to all the water commissioners in the South Platte drainage, not to allow a second filling of any reservoir this year as long as there were junior reservoirs in need of the water for a first filling. After the order was issued, it was reported that Jackson Lake was wasting 300 second-feet into the South Platte river in order to lower the surface of the water in the reservoir enough to permit of needed repairs to the riprapping of the embankment. The Riverside reservoir was also unable to store any water on account of a break in the dam at the headgate of its inlet ditch.

Owing to these changed conditions in District No. 1, an order was sent to Districts Nos. 3, 4, 5, and 6 on September 22, allowing storage in any reservoir.

On November 11 a similar order was sent to Districts Nos. 7, 8, 9, and 23.

The above mentioned order not to allow a second filling of reservoirs during a calendar year if the water was needed for the first filling of a junior reservoir during the same year, met with general approval in all the districts with the single notable exception. From the constant appeals of this district from the orders issued by the Division Engineer, and the further fact that their appeals are based not upon the irrigation laws of this State, but upon "our custom for the past twenty years," it is very evident that they are not so much opposed to the orders themselves as to the simple fact that the Division Engineer presumes to issue an order of any kind relative to the distribution of water in that district.

The courts decree to reservoirs sufficient water "to fill the said reservoir once a year" to a stated height above the bottom of the outlet. Our Supreme Court in 1908 ruled that, "by necessary construction, the statute which provides for these decrees forbids the allowance of more than one filling on one priority in any one year." Even though the facts show that a double filling has been enjoyed, a decree therefor is not proper. The question is: Shall the word "year" used in the decrees and by the Supreme Court, be given its plain, obvious and common-sense meaning, January 1 to December 31, and enforced accordingly, or shall we have a year like a movable feast, the "New Year's Day" of which can be changed to any month to suit the convenience of some reservoir company?

I am, however, of the opinion that the contention of a few reservoir owners that they have decreed rights to commence a second filling in September, on the plea that they are storing water to be used the following year, is not well taken and cannot be sustained if there are other reservoirs in need of this water for a first filling. Any right they may have for a second filling is an *undecreed* right and the date of this second appropriation must necessarily be of later date than the decreed appropriation.

If some "year" other than the calendar year is the law in this State, the following juggling with the storage of water in reservoirs would be the natural outcome.

Reservoir No. 1 has a decreed priority of 1890 for 20,000 acre-feet and Reservoir No. 8 has a decreed priority of 1902 for 40,000 acre-feet. Reservoir No. 1 is filled during the high water in June and July, but No. 8, owing to its late priority, has very little water stored. Reservoir No. 1, during August, therefore, runs her 20,000 acre-feet into No. 8 and is then prepared to demand a second filling upon the plea that the water to be stored is to be used the following year. This would in effect change the junior appropriation of 1902 into a senior one of 1890. Analogous cases to the above can be found in the records of this office for 1911 and 1912.

In the near future the "paramount issue" in this division will be the excessive waste in running water from the rivers to the land irrigated. It is conservative to say that not 50% of the water diverted from the rivers, either for direct irrigation or for storage in reserviors, ever reaches the land irrigated. As a result of this loss by evaporation and seepage or leakage from the ditches and reservoirs, some of the decreed ditches with priorities later than January 1, 1880, were almost entirely dependent during 1910 and 1911 upon reservoir water purchased at a cost of from $3.00 to $4.50 per acre-foot. The reports of the water commissioners show that in some instances, less than 50% of the water diverted from the river ever reached the reservoir. In most of our reservoirs there is an additional loss of not less than 20% by evaporation and seepage from the reservoir itself, before the water is used in irrigation of crops.

It is true that an unknown percentage of this leakage, perhaps 25%, returns to the river at some later period under the alias of seepage or return water.

Is this the economical use or the beneficial use provided for in our statutes?

Is the following excerpt from a decision handed down by an Arizona judge applicable under our laws?

In 1891 Judge Kibbey, of Arizona, in a decision rendered in an adjudication of water rights, says:

> "Following out their sequence the propositions I have advanced as to the ownership of water and the right of appropriation, I am of the opinion that the entire right of the appropriator for irrigation is limited to the delivery of water sufficient for the purpose upon this land at a point where he can use it for irrigation, and that so long as such water is so delivered he may be indifferent to any acts of diversion or obstruction of the flow of water in the natural water course, and has no just cause for complaint therefor. He might be compelled to adopt a more expensive means of delivery of the water to his lands if the means that he has already adopted are such as would result in the loss of water; for, as we have repeatedly affirmed, the water is public property; it is a common stock to which all may go, and no man has any right by faulty construction of his conduits, or by their deficient construction, or by a desire to appropriate more than his share of the water, to diminish that common stock of the water to any greater extent than his necessities require."

In reports from California it is stated that in canals lined with cement concrete 85% of this loss can be saved at a cost of 7.50 cents per square foot of canal lined; in canals lined with cement mortar 60% is saved at a cost of 3.50 cents per square foot lined, and by the use of heavy oil 50% is saved at a cost of 1.20 cents per square foot of canal lined.

The legislature should not only fix by statute the minimum area which may be irrigated by one second-foot of water, but should also require the owners to so improve the physical condition of their ditches, by cementing, paving or some other method, as to reduce this excessive loss to a minimum.

Colorado can well afford to profit by the example set her by California in this kind of conservation of her water supply.

The law requires the Division Engineer to distribute the water according to the priority of appropriation in the division as a whole and without regard to the district lines. This office has been seriously embarrassed in the performance of this duty by forgetful and inefficient water commissioners in a few of the districts.

In a recent decision of one of our district courts, the following language was used:

> "The Court doth further find from the testimony * * * that the defendant company knew or ought to have known that he, the said water commissioner, was in the habit of disregarding the directions of his superiors in the distribution of water, when in his judgment those directions were erroneous."

This water commissioner evidently has an erroneous idea of his relation to the other irrigation officials. Some water commissioners consider that all water that is allowed to pass out of their districts to supply the demands of earlier appropriations in other districts, is a *waste* of water.

At this time when our irrigation interest is one of business development, it is very evident that, "for the good of the service," there should be a change in the personnel of the water commissioners in some of the districts, or else our Constitution should be so amended as to give priority of location a better right than priority of appropriation.

The theory of our system of irrigation officials should at all times be strictly adhered to and it is well to remember that the Division Engineers are not deputies of the State Engineer. They furnish their own bonds for the faithful performance of their duties and should not be embarrassed in the performance of those duties by having their orders over ruled, except in the manner provided in the statutes.

All orders and instructions to water commissioners regarding the distribution of water should pass through the office of the Division Engineer. "Original jurisdiction" should be retired to "Innocuous desuetude."

Through the courtesy of the Union Pacific Railroad Company, the Colorado and Southern Railroad Company, the Denver and Rio Grande Railroad Company, and the Colorado Midland Railroad Company in furnishing me with annual and trip transportation, I have been enabled to make more frequent personal inspections of the different districts than I otherwise would, on account of the insufficient expense fund of this office. These inspections have required during 1912, about 6,000 miles of railroad travel.

Respectfully submitted,

[Signed] F. COGSWELL,
Irrigation Division Engineer, Division No. 1.

CONDENSED STATEMENT OF THE WEEKLY REPORTS OF THE WATER COMMISSIONERS FOR 1911

If we take Districts Nos. 1 to 9, both inclusive, and District No. 64, covering the South Platte river and its tributaries from Platte Canon to the Colorado-Nebraska line, a distance of 250 miles, we have the following table:

	Amount Diverted from the Rivers for Storage in Reservoirs, Acre-Feet	Amount of Reservoir Water Used, Acre-Feet	Amount of Water Used in Irrigation, Acre-Feet	Average Daily Unsupplied Shortage of Water for Irrigation, Second-Feet
April	6,038	None	66,022	4,750
May	2,830	5,026	154,956	5,651
June	5,458	13,314	249,672	5,441
July	12,290	17,514	233,222	4,380
August	548	27,224	146,656	5,116
September	532	10,450	94,360	4,152
October	37,296	410	49,834	None
November	25,564	600	49,762	None
Totals	90,556	74,538	1,044,484	Mean 4,915

NOTE.—The amount of water stored in reservoirs during May, June, July, August and September was reported as storage of water brought over from Districts Nos. 47, 48 and 51, into District No. 3. Water was stored during October under a ruling of the State Engineer that the order of the district court allowing storage in District No. 3 should apply to all districts in the division. The shortage in November was due to the freezing weather that made late fall irrigation impossible.

The "reservoir water used" and "amount of water used in irrigation," given above, do NOT include reservoir water run directly from the reservoirs to the land irrigated without first passing through the river.

DATE OF PRIORITY OF LATEST DITCH DRAWING WATER FOR DIRECT IRRIGATION IN DISTRICTS NOS. 1, 9 AND 64, 1911

Date Saturday	1	Upper 2	3	4	5	6	7	8	9	Upper 64
Apr. 1	Oct., 1882	Nov., 1865	Storage	Oct., 1865	Nov., 1871	June, 1885	Feb., 1865	Jan., 1879	Mch., 1869	June, 1882
Apr. 8	June, 1882	May, 1886	Storage	Oct., 1865	May, 1878	May, 1870	Feb., 1865	Nov., 1862	May, 1874	June, 1882
Apr. 15	June, 1882	Nov., 1865	Apr., 1870	Oct., 1865	Nov., 1871	June, 1873	Feb., 1865	Mch., 1868	May, 1874	June, 1882
Apr. 22	Oct., 1881	Nov., 1865	Apr., 1865	Oct., 1865	Nov., 1871	Apr., 1872	Nov., 1861	Dec., 1862	May, 1865	June, 1875
Apr. 29	Oct., 1881	Nov., 1865	Apr., 1867	Oct., 1865	Sept., 1884	Nov., 1873	Feb., 1871	Dec., 1862	June, 1865	June, 1875
May 6	June, 1882	Nov., 1865	Oct., 1870	Nov., 1865	Mch., 1872	Nov., 1873	Feb., 1871	Mch., 1868	May, 1871	June, 1886
May 13	June, 1882	Nov., 1865	Nov., 1872	Nov., 1865	Mch., 1872	May, 1870	Nov., 1865	Dec., 1865	Oct., 1864	June, 1882
May 20	Oct., 1881	Nov., 1865	Nov., 1872	Nov., 1865		May, 1870	May, 1865	Dec., 1865	Oct., 1864	Oct., 1880
May 27	Oct., 1881	Nov., 1865	Apr., 1873	Nov., 1865		Apr., 1865	Apr., 1865	Dec., 1865	Sept., 1862	Feb., 1876
June 3	Sept., 1882	May, 1866	Feb., 1880	May, 1873	May, 1878	Nov., 1873	Feb., 1871	Mch., 1868	Sept., 1862	June, 1882
June 10	June, 1882	May, 1866	Sept., 1878	Nov., 1877	May, 1878	May, 1870	Feb., 1871	Mch., 1868	Mch., 1863	Feb., 1876
June 17	Oct., 1881	May, 1866		Nov., 1877	Nov., 1871	Apr., 1872	Feb., 1871	Mch., 1868	Oct., 1864	July, 1875
June 24	June, 1882	Oct., 1871		Nov., 1877	Nov., 1871	Apr., 1872	Feb., 1871	Mch., 1868	May, 1871	July, 1875
July 1	June, 1876	May, 1865	Sept., 1871	Oct., 1871	Mch., 1872	Apr., 1865	Feb., 1871	Mch., 1868	Oct., 1864	Sept., 1873
July 8	June, 1882	Jan., 1881	Nov., 1872	Nov., 1877	Mch., 1872	Nov., 1873	Dec., 1874	Jan., 1879	Dec., 1882	June, 1875
July 15	Oct., 1881	July, 1872	Sept., 1871	Oct., 1871	Mch., 1872	Nov., 1873	Dec., 1874	Jan., 1879	May, 1871	July, 1882
July 22	Oct., 1881	July, 1876	Sept., 1871	Oct., 1871	Mch., 1872	June, 1870	Apr., 1872	Nov., 1873	May, 1871	June, 1882
July 29	Oct., 1881	July, 1876	Sept., 1871	Mch., 1867		May, 1868	Feb., 1871	Nov., 1873	Mch., 1869	June, 1882
Aug. 5	Oct., 1881	May, 1865	Apr., 1870	June, 1866	Mch., 1872	Apr., 1863	June, 1864	Dec., 1865	Oct., 1864	Oct., 1880
Aug. 12	Oct., 1881	Nov., 1885	Apr., 1870	June, 1866	May, 1878	June, 1862	May, 1865	Jan., 1879	Oct., 1865	July, 1886
Aug. 19	Oct., 1881	May, 1865	Apr., 1870	June, 1866	Mch., 1872	Oct., 1862	Feb., 1865	Mch., 1868	Oct., 1864	July, 1875
Aug. 26	Oct., 1881	May, 1865	Apr., 1870	June, 1866	Mch., 1872	Oct., 1862	Mch., 1865	Mch., 1868	Oct., 1865	July, 1875
Sept. 2	Apr., 1880	May, 1865	Apr., 1870	Nov., 1865	Mch., 1872	May, 1860	Nov., 1863	Dec., 1865	Oct., 1864	Oct., 1875
Sept. 9	Oct., 1881	May, 1865	Apr., 1870	Nov., 1865	May, 1878	Oct., 1860	May, 1862	Dec., 1865	Oct., 1864	Feb., 1876
Sept. 16	Oct., 1881	May, 1865	Apr., 1870	June, 1866	Mch., 1872	May, 1860	Nov., 1861	Dec., 1865	Mch., 1862	Feb., 1876
Sept. 23	Oct., 1881	May, 1865	Apr., 1870	June, 1866	Mch., 1872	Apr., 1860	Nov., 1861	Dec., 1865	Mch., 1862	Feb., 1876
Sept. 30	Oct., 1881	May, 1865	Apr., 1870	June, 1866	Mch., 1872	May, 1860	Nov., 1861	Dec., 1865	Apr., 1862	Feb., 1876

NOTE.—In District No. 2, below the mouth of St. Vrain Creek, 1874 water was used, supplied by seepage. In District No. 3, at Greeley, 1881 water was used, supplied by seepage. In District No. 64, below Sterling, later ditches were supplied by seepage. During October water was stored in reservoirs in all the districts.

AMOUNT OF WATER BROUGHT OVER FROM DISTRICTS NOS. 47, 48, AND 51 INTO DISTRICT NO. 3, 1911

	From District No. 47, in Acre-Feet	From District No. 48, in Acre-Feet	From District No. 51, in Acre-Feet
May	124	2,590	1,150
June	930	5,250	3,470
July	860	4,870	3,906
August	210	2,226	948
September	78	1,360	235
October	None	1,886	126
November	None	692	None
Totals	2,202	18,874	9,835

I herewith attach a tabulated statement of the water commissioners' annual report for 1911, from which I compile the following tables:

ACREAGE OF CROPS RAISED WITHOUT IRRIGATION

DISTRICT	Alfalfa	Barley	Potatoes	Wheat	Oats	Corn	Spelts	Total
1	850	6,400	1,200	13,000	7,000	15,000	9,000	52,450
2				No dry farming				
3				No report on dry farming				
4				Dry farming a complete failure				
5				No report on dry farming				
6	150	200		10,000	300	1,000	25	11,675
7	3,000	500		14,000	2,000	500		20,000
8				Dry farming a complete failure				
9	560	68		1,055	123	81	Rye 21	1,908
64				No report on dry farming				
65				No report on dry farming				
Totals	4,560	7,168	1,200	38,055	9,423	16,581	9,046	86,033

AVERAGE YIELD PER ACRE OF CROPS RAISED WITHOUT IRRIGATION, 1911

DISTRICT	Alfalfa Tons per Acre	Barley Bushels per Acre	Potatoes Bushels per Acre	Wheat Bushels per Acre	Oats Bushels per Acre	Corn Bushels per Acre	Spelts Bushels per Acre
1..................................	0.5	0.0	0.0	2	0.0	4	5
2..................................			No	dry farming			
3..................................							
4..................................							
5..................................							
6..................................	1	7	0.0	5	6	10	10
7..................................	1	0.0		0.0	0.0	5	
8..................................							
9..................................	1.5	4		8.5	18	8.5	Rye 5
64..................................							
65..................................							

TABULATED STATEMENT OF WATER COMMISSIONERS' ANNUAL REPORTS ON WATER STORED IN RESERVOIRS FOR THE IRRIGATION SEASON OF 1911

District	Capacity, in Acre-Feet	Amount of Water in Reservoirs May 1, 1911—Acre-Feet	Amount of Water in Reservoirs Nov. 1, 1911—Acre-Feet	Amount of Water Held Over from Nov. 1, 1910—Acre-Feet	Area of High Water Line—Acres	Number of Reservoirs Reported
1	139,868	35,953	None	None	9,379	6
2	21,888	21,888	None	None	2,628	20
3	156,264	50,344	16,322	6,726	9,157	60
4	83,792	39,716	17,138	26,534	6,220	7
5	45,075	4,743	15	3,000	2,629	15
6	21,678	3,041	4,179	None	1,632	25
7	19,603	6,766	4,443	75	Not reported	30
8 (a)	5,257	40 ft. deep	None	32 ft. deep	175	1
9	28,420	1,584	2,305	246	970	34
23	138,400	76,997	71,662	83,284	5,840	3
46			No reservoirs	reported		
47			No reservoirs	reported		
48			No reservoirs	reported		
64 (b)	28,352	2,870	221	None	1,670	1
65	547	436	450	368	Not reported	5
Totals.....	689,144	244,338	116,735	120,233	40,300	207

(a) All in Castlewood reservoir. When reservoir is full, gauge-rod reads 45 feet.

(b) All in Julesburg reservoir

CONDENSED STATEMENT OF THE WEEKLY REPORTS OF THE WATER COMMISSIONERS FOR 1912

If we take Districts Nos. 1 to 9, inclusive, and District No. 64, covering the South Platte River and its tributaries from Platte Canon to the Colorado-Nebraska line, a distance of 250 miles, we have the following table:

	Amount Diverted from the Rivers for Storage n Reservoirs, in Acre-Feet	Amount of Reservoir Water Used, in Acre-Feet	Amount of Water Used in Irrigation, in Acre-Feet	Average Daily Unsupplied Shortage of Water for Irrigation, in Second-Feet
April	42,332	510	34,566	117
May	109,548	4,130	171,856	1,369
June	84,670	1,470	445,544	1,760
July	61,626	15,720	423,874	447
August	21,380	40,268	247,754	1,046
September	45,938	35,538	135,072	877
October	103,306	200	47,138	54
November	90,304	0	17,060	0
Totals	559,104	97,834	1,522,864	Mean 810

NOTE.—The "reservoir water used" and "amount of water used in irrigation," given above, do NOT include reservoir water run directly from the reservoirs to the land irrigated without first passing through the river.

THE WEEKLY REPORTS OF THE WATER COMMISSIONERS SHOW THE FOLLOWING AMOUNTS OF WATER, IN ACRE-FEET, DIVERTED FROM THE RIVERS FOR STORAGE IN RESERVOIRS DURING 1912

DISTRICT.	April	May	June	July	August	September	October	November	Total
1	10,374	12,460	19,180	35,194	14,888	26,000	41,530	51,484	210,910
2	6,370	10,500	9,290	12,400	5,710	8,186	23,380	15,600	91,436
3	9,720	26,180	25,934	18,184	982	9,264	18,800	9,660	112,724
4	2,818	22,208	12,740	1,596	0	1,324	9,064	7,322	57,072
5	4,516	11,272	3,500	0	0	804	3,844	0	23,936
6	1,920	14,320	2,300	0	0	360	1,970	1,800	22,670
7	4,304	8,420	9,820	120	0	0	100	950	23,714
8	No storage	except from	Cherry Creek						
9	2,310	4,188	1,906	132	0	0	418	688	9,642
64	Julesburg re	servoir full A	pril 1				4,200	2,800	7,000
Totals	42,332	109,548	84,670	61,626	21,380	45,938	103,306	90,304	559,104

THE WEEKLY REPORTS OF THE WATER COMMISSIONERS SHOW THE FOLLOWING AMOUNTS OF WATER, IN ACRE-FEET, USED IN IRRIGATION DURING 1912

DISTRICT.	April	May	June	July	August	September	October	November	Total
1	21,214	33,662	46,450	54,538	41,534	30,404	21,070	15,080	263,552
2	5,040	27,426	57,998	54,320	45,010	27,080	10,084	440	227,398
3	360	28,860	128,370	101,520	51,792	21,826	0	0	332,728
4	640	11,530	48,422	47,300	23,394	9,488	200	0	140,974
5	0	9,618	39,850	29,540	14,322	5,894	0	0	99,224
6	690	13,242	35,992	27,350	11,452	4,992	910	0	94,628
7	640	10,402	27,100	32,140	21,912	8,984	6,290	1,540	109,008
8	2,740	16,740	30,754	25,044	20,100	12,774	7,708	0	115,860
9	0	1,772	5,968	6,072	5,878	3,508	876	0	24,074
64	3,242	18,604	24,640	46,050	12,760	10,122	0	0	115,418
Totals	34,566	171,856	445,544	423,874	247,754	135,072	47,138	17,060	1,522,864

NOTE.—The above quantitities do not include the water run from reservoirs directly to the land irrigated without first passing through the river.

AMOUNT OF WATER BROUGHT OVER FROM DISTRICTS NOS. 47, 48, AND 51 INTO DISTRICT NO. 3, 1912

	From District No. 47, in Acre-Feet	From District No. 48, in Acre-Feet	From District No. 51, in Acre-Feet
April	0	540	0
May	70	1,260	280
June	1,496	11,010	5,308
July	2,208	8,382	7,634
August	512	3,600	2,332
September	148	1,514	168
October	48	1,002	0
November	0	760	0
Totals	4,482	28,068	15,722

I herewith attach a tabulated statement of the water commissioners' annual reports for 1912, from which I compile the following tables:

ACREAGE OF CROPS RAISED WITHOUT IRRIGATION

DISTRICT	Alfalfa	Barley	Potatoes	Wheat	Oats	Corn	Spelts	Total
1	1,000	10,000	5,000	20,000	15,000	40,000	10,000	101,000
2	100	0	0	1,000	150	1,500	0	2,750
3				No dry farm	ing in district			
4	0	1,000	0	50,000	5,000	1,000	500	57,500
5	0	50	0	1,000	100	200	0	1,350
6	150	350	0	10,000	350	800	50	11,700
7	100	0	0	2,500	0	0	0	2,600
8	500	0	150	5,000	2,000	3,000	0	10,650
9	211	14	0	1,123	214	128	0	1,690
64	200	3,000	1,300	45,000	7,000	3,700	1,000	61,200
65				Not re	ported			
Totals	2,261	14,414	6,450	135,623	29,814	50,328	11,550	250,440

AVERAGE YIELD PER ACRE OF CROPS RAISED WITHOUT IRRIGATION, 1912

DISTRICT	Alfalfa Tons per Acre	Barley Bushels per Acre	Potatoes Bushels per Acre	Wheat Bushels per Acre	Oats Bushels per Acre	Corn Bushels per Acre	Spelts Bushels per Acre
1	2	22	30	12	20	12	20
2	2			15	20	18	
3			No dry	farming in d	istrict		
4		25		20	10	30	20
5		35		20	30	25	
6	2	25		25	40	20	25
7	1.50			18			
8	1			18	17	15	
9	2.25	18		23.50	48	15	
64	2.50	25	50	20	42	24	22
65				Not reported			

TABULATED STATEMENT OF WATER COMMISSIONERS' ANNUAL REPORTS ON WATER STORED IN RESERVOIRS FOR THE IRRIGATION SEASON OF 1912

District	Capacity in Acre-Feet	Amount of Water in Reservoirs May 1, 1912—Acre-Feet	Amount of Water in Reservoirs Nov. 1, 1912—Acre-Feet	Amount of Water Held over from Nov. 1, 1911—Acre-feet	Area of High Water Line—Acres	Number of Reservoirs Reported
1	239,869	52,940	27,376	None	14,095	6
2	107,920	17,704	53,830	None	6,780	17
3	154,821	51,022	83,794	16,322	10,076	60
4	93,547	22,268	49,601	17,138	6,645	11
5	41,912	18,042	33,819	15	2,199	14
6	31,974	19,683	22,079	4,179	2,125	18
7	100,644	28,532	41,318	4,443		46
8 (a)	5,257	4,032	3,507	None	175	1
9	28,433	11,207	20,706	2,305	1,729	36
23	138,400	79,793	111,512	71,662	5,840	3
46			No reservoirs reported			
47			No reservoirs reported			
48			No reservoirs reported			
64 (b)	28,178	22,038	15,411	221	1,578	1
Totals.....	11,128	11,124	11,128	450	15	5
Totals.....	982,083	338,385	474,081	116,735	51,257	218

(a) All in Castlewood reservoir; estimated. (b) All in Julesburg reservoir.

22	23	24	25	26	27	28	29	30	31	32	33	1
ROM CANALS—IN ACRES									COST—DOLLARS			District
sture	Oats	Millet	Celery	Peas	Corn	Onions	Cabbage	Total Irrigated	Superin- tendence	Repairs	Improve- ments	
							412	41,178	$12,110	$12,198	$12,055	1
			125					68,849	15,320	3,070	5,675	2
								248,480	17,835	57,885	82,485	3
				635				99,645	8,310	2,575	6,120	4
								88,837	7,453	11,005	120,642	5
								90,799	5,130	9,420	12,250	6
1,580								77,220				7
			155				400	41,270			3,782	8
			2		98		31	6,388	2,422	1,554	1,068	9
								30,610				23
39,616								83,980				46
								50,137				47
								4,008				48
								106,381	4,855	3,965	1,700	64
	15							2,680	400	975	197	65
1,196	15		282	635	98		843	1,040,462	$73,835	$102,647	$245,974	......Totals

ANNUAL REPORT OF IRRIGATION DIVISION ENGINEER, DIVISION No. 2, FOR 1911

Pueblo, Colorado, November 30, 1911.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit my report for Division No. 2, for the fiscal year ending November 30, 1911.

There was but little snow in the mountains; the streams were very low, reservoirs empty or nearly so—anything but a bright outlook for the beginning of the season. The ground was exceedingly dry and cracked, taking two or three times as much water as usual at this time. These conditions continued until after seeding time. Much seed failed to germinate, and some was blown out of the ground. Sugar beets and cantaloupes failed to come up. Many hundreds of acres were a total failure.

This shortage of water did not improve the temper of the water-consumers, who were soon accusing us of almost every crime on the calendar. However, a few showers changed things wonderfully and brought peace temporarily, and activity in farming.

Throughout the entire year there was a shortage of water—in some districts much worse than in others. The suffering even for stock water was great, and many crops were entirely abandoned.

The precipitation for the past fiscal year was, for each month, as follows:

November, 1910, 0.53; December, 1910, 0.15; January, 1911, 0.04; February, 1911, 0.99; March, 1911, 0.29; April, 1911, 0.82; May, 1911, 0.40; June, 1911, 0.46; July, 1911, 2.81; August, 1911, 0.37; September, 1911, 0.32; October, 1911, 1.09; a total of 8.27, an average of 0.689.

In the valley the sugar-beet crop was good—short in acreage, higher than usual in sugar content, and above the average in tonnage per acre. There were 29,887 acres in this crop.

The alfalfa yield was good. The first cut was short, but the next two seemed to make up for it. There were 193,449 acres, yielding about four tons per acre. Alfalfa sold for from $7 to $11 per ton in the stack, and $12 to $14 baled, f. o. b., locality governing the price.

The quality of wheat was excellent, and the yield per acre from ten to sixty bushels.

The acreage of oats was less than usual, but the yield was good—sixty to 100 bushels per acre. Oats and wheat aggregated 134,437 acres.

The melon crop was short in acreage, but heavy in yield of choice melons, bringing to the farmer good prices throughout the season.

The acreage of celery was larger than ever. Many growers received $1,200 per acre. About sixty cars were shipped out of the valley.

The fruit crop was far better in quality and yield than ever before, owing to better care and cultivation. A conservative estimate in dollars and cents by our experienced fruit-growers is $1,500,000 for the valley, including cherries, peaches, prunes and plums, to say nothing of grapes and bush fruits, which would add many thousands of dollars to the above. There were fifty cars of Mexican beans, at 3 to 4 cents by the car, and several cars of honey. From Pueblo were shipped from two to five carloads of vegetables per week to Missouri, Kansas, Oklahoma, Texas and Tennessee. These consisted largely of cabbages, cucumbers, tomatoes, beans, lettuce and onions.

The canning and pickling factories were all run to full capacity during the season.

The stock-feeding business has assumed huge proportions. One hundred and forty thousand head of lambs, 20,000 beeves, and 6,000 to 10,000 head of hogs are being fattened for the eastern markets.

Twelve hundred acres of cucumbers and 400 acres of melons were raised for seed alone. There were 19,542 acres of orchards, and 18,756 acres of other crops, yielding good prices. A large additional acreage is contracted for spring planting.

There are 69,757 acres in natural hay, with an average of one ton per acre, worth from $16 to $20 per ton, baled.

I can only reiterate previous suggestions as to law. Every water commissioner should be paid by the state, eliminating politics, and placing all on a civil-service basis. This would improve the system 100 per cent.

Owing to the many new irrigation projects, the duties of the water officers have been multiplied many times. The calls on their time have been quadrupled—in fact, everything increased many times—except ways and means to meet these extra demands. The expenses of this office are more than three times the amount set aside by the state for the same.

Yours truly,

[Signed] E. R. CHEW,

Irrigation Division Engineer, Division No. 2.

Annual Report of Irrigation Division Engineer, Division No. 2, for 1912

Pueblo, Colorado, November 30, 1912.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit my report as Irrigation Division Engineer of Division No. 2.

There are in this division 2,261 ditches, with 13,167.90 cubic feet per second decreed water, and a large number of filings.

The past season has been a very prosperous one in the entire division. The precipitation, while only a fraction of an inch above normal, has been uniformly distributed throughout the season. This, with an abundance of water to supply all the ditches for irrigation, has been most beneficial to the farmer and has produced excellent returns on all of the crops grown in this valley—alfalfa, sugar beets, melons, cantaloupes, oats, wheat, corn, barley, onions, cabbage and all of the various garden products.

prosperity of this valley.

I would further recommend that a more adequate system of stream and ditch gauging be established, and that a fund be appropriated for the maintenance and observation of the gauges and records thereof.

In order to distribute water in accordance with the decreed rights, it is necessary to have an accurate knowledge of the quantities of water available at selected points on the trunk stream and its tributaries. In the case of the Arkansas drainage, this necessity is becoming more and more apparent. Trouble and misunderstandings which arise in the distribution of water are commonly due to lack of data, or to incorrect data, concerning the quantities of water available.

Past experience in the distribution of water in the Arkansas drainage would indicate that the accuracy of data would be much improved if the following changes and improvements in river stations were carried out. The station at Oxford Farmers' dam should be relocated at a point higher up. The Rocky Ford High Line dam would probably supply a much better location. The results obtained at the present location have always been unreliable, and must continue to be under present conditions. It would be necessary to erect a cable for flood

measurements at a new location. A cable should be placed across the river near the gauge at La Junta. A concrete bridge being erected at the old station will make it necessary to find a new point for gauging flood stages, and a cable station seems the only solution. A cable station should be established at the Carmen dam on the Purgatoire river, about twenty-two miles above the mouth. This station would give advance information as to water available for the lower river. Data as to floods on the tributaries are now only approximate, as few measurements are made on these streams. A few regular stations on the larger tributaries, such as the Fountain and Huerfano, would better this condition.

As the expense of the above changes would be too large for the State Engineering Department to bear, an appropriation of $1,500 from the legislature would be necessary.

In the lower Arkansas, as a result of the large quantity of sediment carried by the river, sand settles in the upper portions of many ditches, making it necessary to rerate them frequently. If the water commissioners were taught to make these ratings, the accuracy of this branch of the distribution would be greatly increased. The meter and apparatus would cost about $75 per man. As many of the commissioners show an interest in learning to use a meter, it would be a simple matter to instruct in its use sufficiently for this purpose.

I wish to pay my respects to Water District No. 16 in the State of Colorado, which consists of the Huerfano river and its tributaries. It has been a continual source of trouble to the water officials during the year 1912; in fact, for years. I have before in a brief way called attention to the condition which the water officials are required to meet in Water District No. 16, but the matter has now reached a point where something must be done.

There are three sets of decrees concerning the earliest priorities on the Huerfano.

The first adjudication proceeding was begun in Pueblo county by the filing of a petition by Cash D. Henderson, on May 11, 1887, and by the entry of an order on May 20, 1887, appointing William P. Beck referee. Testimony concerning the use of water by ditches in Pueblo county only was taken. After the testimony had been taken, it appeared that the parties who posted the notices for Referee Beck could not be found and were unknown, and that no affidavit of the posting of the notices had been filed as required by law. A new order of publication was therefore made. Referee Beck resigned on account of ill-health, and Theodore A. Sloane was appointed referee. New service and publication were made, and Referee Sloane again took the testimony concerning the Pueblo county ditches only. On September 1, 1891, Samuel P. Dale, Judge of the District Court, signed the decree, decreeing to the various ditches of Pueblo county priorities to the use of water to the full capacities of the ditches and without regard to the acreage irrigated. I shall hereafter speak of the decrees in this first proceeding as the "Pueblo decrees."

The second proceeding on water rights in Water District No. 16 was begun in the district court of Huerfano county in the usual way, by entry of an order appointing John F. Read referee, on January 24, 1888. This proceeding covered only the ditches in Huerfano county, about eight months after the proceedings had begun in the Pueblo district court. The final decree in this proceeding, in Huerfano county, was entered June 12, 1889. These last decrees are known as the "Read decrees."

The third proceeding on the early water rights in Water District No. 16 was begun in the district court of Huerfano county on October 14, 1895, by the appointment of Fred O. Roof referee. On January 22, 1896, Fred O. Roof resigned, and James R. Killian was appointed referee on January 23, 1896. This proceeding was begun on a petition filed by one of the Pueblo county ditches, which had already participated in the Pueblo decrees. Notices were given out to all ditches of Water District No. 16, whether they were in Pueblo County or Huerfano County. On February 23 a final decree was rendered in this third proceeding. These last decrees are known as the "Killian decrees."

The ditch-owners having Pueblo decrees have claimed that the Read decrees are no good and should not be recognized. The owners of the Read decrees claim that the Killian decrees and the Pueblo county decrees should not be recognized. Each set of decrees adjudicates rights from 1859 or 1860 down to the time when the respective decrees were entered. Some of the ditches have decrees in Pueblo county and in Huerfano county. The water commissioner is expected by the ditch-owners to solve this tangle, and to distribute the water fairly and justly, although lawyers who have studied the situation differ in opinion. The water commissioner and my office have done everything possible to try to work out a solution of this difficulty and to be fair with everyone concerned.

I believe that there will be serious trouble unless this situation is adjusted. There should be some legislation to straighten this matter out, or else most serious results will follow. All last summer there was litigation between Pueblo county and Huerfano county, and finally Judge Owen, of Colorado Springs, entered an order dividing the water between Pueblo county and Huerfano county ditches equally. We had no funds to make measurements of the amount of water on the Huerfano, or that emptied into the Huerfano from its tributaries. So far as we know, this order is still in effect, and because of limited funds we have not been able to install measuring devices, or to enforce the law in reference to the placing of proper headgates and measuring weirs. The water commissioner, his deputies and I myself have worked diligently and in every way possible to see that the ditches entitled to the use of water are receiving their water supply.

I would recommend, in addition to some kind of legislation to clear up this tangle, that a sufficient appropriation should be made to enable the division engineer of this division to take whatever action may be necessary to clear up the situation, by placing proper measuring devices on the streams, and by requiring the installation of headgates and measuring weirs upon the ditches. The ditches have been in litigation over these questions for more than a year and have not yet themselves settled their rights.

I understand that proceedings will soon be begun by some of the ditches to correct these matters, but nothing has been accomplished yet through the court in this particular, and it is doubtful, in my mind, whether
tl
g
w
a

e
o

ANNUAL REPORT OF IRRIGATION DIVISION ENGINEER, DIVISION No. 3, FOR 1911

Alamosa, Colorado, November 30, 1911.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit to you my annual report as Irrigatión Division Engineer for Division No. 3, and also the annual reports of the water commissioners in my division during the season of 1911.

We have had plenty of water in all the ditches this season, and we have had a great deal more rain than has been good for the potato crop, which was damaged a great deal by the continual heavy rains. All other crops were good.

I have been over the division a great deal this season. I assisted Mr. B. S. Clayton, one of the men from your office, in rating a number of the ditches and also in gauging the streams.

In District No. 20 the commissioner, Mr. Z. J. Wilson, has done good work. This is a large district and requires a great deal of work on the part of the commissioner. I will say the commissioner has done well, it being his first year in the office. In this district a great deal of work is being done. The Farmers' Union Ditch Company is building a large reservoir, with a capacity of about 40,000 acre-feet, which will be completed next summer. It is now about half completed.

The Travelers' Insurance Company is also building a reservoir, which, when completed, will be a great benefit to the valley. The Gibson, Robinson & Shahan people are developing a great deal of water in this district by an extensive system of drainage. A large amount of land will be redeemed, and a large area will be put into cultivation under their system.

In District No. 21 the work by the commissioner, Mr. Thomas McCunniff, has been good. The flow of water in this district was good all through the season, and the crops were very good.

In District No. 22 there was a shortage of water for a time, but not enough to hurt the crops. The water commissioner, Mr. J. A. Reynolds, has handled this district in a very satisfactory manner.

In District No. 24 there has been some trouble between the Mexicans and the Costilla Estates Development Company. I was called over there a number of times to settle disputes, which I did to the satisfaction of all parties concerned. The crops in this district were very good, with the exception of potatoes. The Costilla Estates people have just completed one of the finest reservoirs I have ever seen. It has a capacity of about 104,000 acre-feet. They have at the present writing from 15,000 to 18,000 acre-feet stored, and expect to have over 60,000 acre-feet by June 1, 1912. This company is doing excellent work in developing the valley and deserves a great deal of credit.

In District No. 25 the commissioner, Mr. John L. Charles, has not had any trouble. There has been plenty of water, and the crops were good.

In District No. 26 the commissioner, Mr. Alex Russell, has not reported any trouble. There was plenty of water for everybody, and the crops were good.

In District No. 27 the commissioner, Mr. A. M. Coolbroth, has not reported any trouble. There has been plenty of water, and crops were good.

In District No. 35 the commissioner, Mr. I. N. Janney, has had some trouble, but nothing serious. There is very little farming being done in this district, but there is a great deal of hay raised, and they always have plenty of water for the growing of their hay. There is a reservoir being built, which, when completed, will be a great benefit to this district.

During the season we have had some extremely high water, especially in the month of October, which did considerable damage to railroad property along the Rio Grande, and also some damage to crops on the Conejos River.

In my travels over the division I have found things in fairly good condition. The greatest difficulty for the water commissioners is to persuade people to comply with the law in regard to headgates and measuring flumes. If this law could be printed in the form of a circular letter, and sent to the commissioners in sufficient number so that they could distribute them among the ditch owners, I think it would help the water commissioners in their work. I have been talking a great deal to the ditch-owners about this matter, and some of them have agreed to put in proper headgates and flumes as early as possible.

As early as practicable I intend to go all over the entire division and try to impress upon the ditch owners that they must put in their headgates and flumes in good shape, so that I can rate their ditches properly, and so as to give the water commissioners a chance to do their work properly.

Their is considerable work done in the valley in the line of drainage, which will redeem thousands of acres of land. There were over 5,000 acres of sugar beets grown in the valley this season, and I think there will be double that amount next season. With the reservoirs now being built and the drainage systems completed, I look for at least 25 per cent more land put under cultivation in the next two years in the valley. Some of the crops have made remarkable yields this season. Mr. Oscar Cling threshed as high as 144 2-3 bushels of oats per acre, weighing forty-six pounds to the bushel.

I should like very much to see a gauging station put in on the Alamosa River. I cannot see how the water commissioners can do their work properly when water is drawn from the Terrace reservoir, as it will be next season, without one. I, therefore, urge that one be established if possible.

In conclusion, I wish to say that all the water commissioners in this division have done remarkably well under the conditions as they now exist. There has been no litigation in this division, and no serious trouble.

Very truly yours,

[Signed] FREDERICK W. SWANSON,
Irrigation Division Engineer, Division No. 3.

Annual Report of Irrigation Division Engineer, Division No. 3, for 1912

Alamosa, Colorado, November 30, 1912.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit my annual report as Irrigation Division Engineer for Division No. 3, Rio Grande Division, the annual reports of the several water commissioners, and tabulation for the entire division during the irrigation season of 1912.

There has been a good flow of water in nearly all the water districts in the whole division. There have been some complaints in some of the districts that the water commissioners have not enforced the law in regard to proper headgates and measuring flumes being installed in some of the smaller ditches. I think that this trouble will all be satisfactorily settled before water is needed for next season. The commissioners have all given good service, with the exception of the commissioner in District No. 35. I would recommend that this district be abolished, as it is a small district, and the county commissioners of Costilla county do not want to pay for the service of the commissioner. I would therefore recommend that the portion of District No. 35 lying south of the Trinchera grant line be added to District No. 24, and that the portion of this district lying north of said line be added to District No. 25. It is useless to try to get a man to give attention to this district, because it would not require more than one-fourth of his time, and the county commissioners would object to paying for even that much. It is, therefore, useless to have a commissioner in this district. I do not think that the report from this district shows more than one-fourth of the water used or of the crops that have been grown there.

A brief summary of each district for the season follows:

District No. 20, which is the largest district in the division, has been well attended to by Mr. Wilson. There has been very little complaint in this district. Mr. Wilson has had a hard time to get crop reports from the different ditch companies, so I do not believe that his report shows more than three-fourths of the actual amount of crops grown in this district. Mr. Wilson has done all the work himself, but it is too much for one man to undertake. There are now under construction five reservoirs in this district, and some of them are storing water. They will all be completed next year, and when they are completed this district will have an abundance of water for all time to come. Mr. Wilson has neglected to report the length of ditches in the district, but it is only about four miles more than last year. He has also failed to report the average daily quantity of water in second-feet used during the season. The drainage work that is being done in this district is developing a great deal of water, and is also redeeming many thousand acres of land which was worthless, and this is some of the very best land in the valley.

District No. 21, which includes the La Jara and Alamosa rivers and Hot creek, has two reservoirs—the La Jara, which is completed, and the Terrace, which will be completed next season. Mr. McCunniff, the water commissioner in this district, had some trouble with the Terrace reservoir people, but it was all settled satisfactorily The crops in this district were very good, as usual, with the exception of the sugar beets. It would be a great help to the commissioner if there were a gauging station on the Alamosa river.

District No. 22 comprises the Conejos river and its tributaries. Mr. Jesse Reynolds, the water commissioner, has given very good satisfaction. The crops were good. There is a great deal of new land being put under cultivation in this district, and I look for a large increase in the crop report for next season. I understand that there is a contract let for the construction of a reservoir on the Conejos river. When it is completed, it will be a great help to this district, as there is a great deal of water going to waste in the spring, which could be stored for use later, when the water is short in the fall.

Mr. J. P. Sanchez, water commissioner of District No. 24, has done very well this season. The Costilla Estate has one of the finest reservoirs in the state. Its capacity is 104,000 acre-feet. In addition, there are some smaller reservoirs. This company is doing great work for the upbuilding of the waste portion of the valley and deserves a great deal of credit. The crops under its system of reservoirs were very good. It now has water stored in its reservoirs to irrigate all the lands under cultivation at the present time, and is adding to the supply daily. I look for this part of the valley to be one of the most productive in the near future.

District No. 25 is looked after by Water Commissioner J. L. Charles, very satisfactorily. It is not a large district, but is a very prosperous one. The farmers in this district seem to be well-to-do, and there are no complaints about the water.

District No. 26 is in the northern part of the valley. The water commissioner in this district is Mr. Alex Russell. He has made no report of shortage of water. This is a very prosperous district. The crops are very good and there has been no trouble of any kind.

In District No. 27 the water commissioner, Mr. A. N. Coolbroth, has not reported any trouble. The crops in this district were very good. This is a very small district and Mr. Coolbroth seems to handle it with great satisfaction to the water-users.

In District No. 35 Mr. I. N. Janney, the water commissioner, has not given much attention to his duties as water commissioner, because it is hard for him to get his salary, and it would take only a small part of his time to look after the district; so he cannot afford to spend his time. As I have stated before, this district should be divided between Nos. 24 and 25. I think it would be more satisfactory. There is a great deal of new land in cultivation on the Trinchera grant and considerable crops being raised there, but no report of them.

The reports from some of the commissioners are not complete, but they are the best obtainable. The water commissioners' work will never be satisfactory until they are under the control of the state and paid by the state. I have no fault to find with the commissioners. I think they do the best they can for the pay

they receive. I hope that there will be a bill passed by the next legislature taking the water distribution out of the hands of the county commissioners. Owing to the incomplete reports from some of the water commissioners, it is a hard matter to determine the duty of water, but to my best knowledge it is one second-foot for eighty acres.

Respectfully submitted,

[Signed] FREDERICK W. SWANSON,
Irrigation Division Engineer, Division No. 3.

ANNUAL REPORT OF IRRIGATION DIVISION ENGINEER, DIVISION NO. 4, FOR 1911

Delta, Colorado, November 30, 1911.

State Engineer, Denver, Colorado.

Dear Sir: I have the honor to present you my annual report of Irrigation Division No. 4 for the season 1911. Under separate cover I am sending you the annual reports of the various water commissioners, together with the field books which have been sent to this office.

The reports of the water commissioners are very meager indeed. There was such an abundance of water this season that only about one-third of the water commissioners were called out, and most of these for only a short time, and their services did not extend throughout their districts.

The heavy rains in the early part of October did considerable damage to ditches and crops. Two large reservoirs, one on Plateau creek and one on the Gunnison river, broke, causing considerable damage by the water thus escaping. The crops generally throughout the division were excellent. Delta, Mesa, Montrose, and Montezuma counties had abundant fruit crops, and grain, hay, and sugar beets were especially good.

It is very difficult to get complete reports relative to the use of water for irrigation purposes, or to get complete crop reports, for the reasons stated above.

The work of the various water commissioners was generally very satisfactory, and there seems to have been few, if any, disputes. Only one appeal from the decisions of the water commissioners reached this office, and the question at issue will be decided by this office in the early part of December. This was an appeal taken from the decision of Water Commissioner George M. Saunders, District 42, Mesa county, relative to the water used by the town of Palisade.

In Districts Nos. 29, 30, 31, 32, 33, 34, 63, and 69 the services of the water commissioners were not needed, and no reports are at hand.

District No. 28—J. Roy Hicks, commissioner, Sargents, Colorado: The commissioner was employed five days, and while he made no report to this office, he sent his field book to you.

District No. 40—D. S. Doughty, commissioner, Delta, Colorado: The commissioner was employed from May 22 to November 10. He was assisted by thirteen deputies, who served on an average of ninety days each, the exact number of days not being given in his report.

The work of the commissioner and his deputies extended over Dough Spoon, Oak, Dirty George, Ward, Tongue, Young's, Surface, Currant, Leroux, Terror, Hubbard and Minnesota creeks, and the Smith Fork of the Gunnison river. On the Gunnison river and the North Fork of the Gunnison river no services were required.

Tributary to the above streams, and extending over a distance of seventy-five miles, is a chain of reservoirs which store about one billion cubic feet of water used for irrigation purposes. The amount of water used from the public streams cannot be ascertained from the commissioner's report, owing to the fact that a large amount of water was used before he began work and after he finished. He sent us the following crop report, which does not include the acreage on the North Fork of the Gunnison, nor the Gunnison valley:

	Acres	
Alfalfa	19,029	
Cereals	4,293	
Orchards	6,583	
Other crops	2,854	
Total		32,759

District No. 41—A. J. Baxter, commissioner, Montrose, Colorado: This district extends along the Lower Uncompahgre and tributaries.

The commissioners worked 140 days	$700.00
Four deputies, 132 days	330.00

Owing to the heavy rains, and to the fact that the Gunnison tunnel furnished about 300 second-feet of water this season, the district was blessed with an abundance of water. When the Gunnison tunnel project is completed, which will be within the next year or two, this will be one of the best watered sections in the state. The following is the crop report:

	Acres	
Alfalfa	17,855	
Natural grass	1,175	
Cereals	10,150	
Orchards	3,855	
Potatoes	5,945	
Sugar beets	3,355	
Other crops	6,390	
Total		48,725

No data as to the duty of water are given, nor can any be ascertained, for the reasons already given.

District No. 42—George M. Saunders, commissioner, Mesa, Colorado:

The commissioner was employed 102 days	$ 510.00
Seven deputies, 500 days	1,250.00

The commissioner's work extended over only a portion of the district, and consequently his report does not cover a large portion of the district. There are no statistics available from the Grand valley. From the part of the district covered he sends us the following crop report:

	Acres	
Alfalfa	11,758	
Natural grass	679	
Cereals	2,345	
Orchards	1,013	
Market gardens	109	
Potatoes	294	
Other crops	515	
Total		16,713

District No. 59—Frank W. Harper, commissioner, Gunnison, Colorado: The commissioner was employed but five days, and makes no report as to the use of water, crops, etc.

District No. 60—San Miguel River, H. C. Browning, commissioner, Coventry, Colorado: The commissioner had no deputies and he was employed only part of the time. He sent weekly reports of weather, water supply, etc., to this office. His reports show an excellent supply of water for the season. He sends us a field book and reports for such ditches as required his services, and the following crop report:

	Acres	
Alfalfa, timothy, etc	4,900	
Cereals	3,569	
Orchards	910	
Potatoes and market gardening	207	
Corn	450	
Other crops	92	
Total		10,128

He reports the use of 27,220 acre-feet of water. The number of acres irrigated was 10,128. This gives a duty of water of 2.68 acre-feet per acre.

District No. 61—W. S. Jones, commissioner, Paradox, Colorado: The commissioner makes a complete report for the portion of his district requiring his services. The report shows that 3,230 acre-feet of water was used on 1,141 acres, making the duty of water 2.84 acre-feet per acre. The commissioner sent weekly reports to this office during the season. His crop report is as follows:

	Acres	
Alfalfa	570	
Natural grass	205	
Cereals	299	
Orchards	37	
Other crops	30	
Total		1,141

District No. 62—W. O. Brower, commissioner, Cimarron, Colorado: The commissioner sent in a field book and a partial report. As he was employed but ten days, he has little to report. He reports a total appropriation of 76.3 second-feet, which was used to irrigate 6,040 acres of land. The crop report is as follows:

	Acres	
Timothy	556	
Natural grass	30	
Cereals	78	
Potatoes	7	
Not designated	5,369	
Total		6,040

District No. 69—Upper Uncompahgre river and tributaries, John W. Martin, commissioner, Ridgway, Colorado: The commissioner was employed at various times from April 15 to November 1.

There are no data as to the duty of water. The crop report is excellent and was gotten by a house to house canvass of the district. There was no shortage of water, and the crops generally were good. The crop report is as follows:

	Acres	
Alfalfa and mixed hay	7,697	
Natural grasses	2,283	
Cereals	3,939	
Orchards	116	
Potatoes	239	
Other crops	126	
Total		14,400

There are several private irrigation projects under way in various parts of the division, which, when completed, will redeem a large number of acres of arid land. The completion of the irrigation projects in Montrose and Mesa counties under the Reclamation Service will add a vast empire to the irrigated lands of Division No. 4.

A heavy snowfall in the mountains in October and November insured plenty of water for the season 1912.

Very respectfully yours,

[Signed] H. C. GETTY,
Irrigation Division Engineer, Division No. 4.

Annual Report of Irrigation Division Engineer, Division No. 4, for 1912

State Engineer, Denver, Colorado.

Dear Sir: In submitting my report for the year 1912, I desire briefly to give a general description of this division, which consists of lands in the State of Colorado watered by the San Juan river and its tributaries, and also of lands in the State of Colorado watered by the Grand river and its tributaries, below the mouth of Roan creek.

This division is located in southwestern Colorado and contains some of the best agricultural lands in the state.

The best-developed water systems are in the counties of Mesa, Montrose, and Delta.

In Mesa county the High Line canal is being built by the United States Reclamation Service, which will add a large territory to the irrigated portion of Mesa county.

Probably the greatest irrigation project in the state, now nearing completion, is the Gunnison tunnel project, which will add 150,000 acres to the irrigated portion of Montrose and Delta counties. The six-mile tunnel, with a capacity of 1,300 second-feet of water, is completed, and the canals and laterals are in course of construction. This year the tunnel carried 350 second-feet of water into the Uncompahgre valley for the purpose of irrigation.

In Montrose county the Lilylands Company and the Paradox Valley Irrigation, Land and Development Company are doing a vast amount of work in ditch and reservoir building, as is also being done in Montrose and San Miguel counties by the San Miguel Irrigation and Land Company and the San Miguel Development Company.

During this year the Lone Cone Ditch and Reservoir Company completed a reservoir with a capacity of 77,000,000 cubic-feet.

On Grand mesa there is a string of reservoirs reaching from the lower end of Grand mesa to the Ragged range, a distance of from seventy-five to 100 miles, with a capacity of 72,000 acre-feet of water, which is used for irrigation in Delta and Mesa counties.

There is also considerable work in the reclamation line in La Plata, Montezuma, and Dolores counties.

Owing to its excellent climatic conditions and its vast empire of rich lands, when the various enterprises now in the course of construction are completed, this will be one of the most important irrigation divisions in the state.

There were very few disputes about water this year. The only one of any importance occurred in District No. 41, Montrose county, between Mr. A. J. Baxter, water commissioner, District No. 41, and Mr. C. T. Pease, engineer in charge of the United States Reclamation Service, under the Gunnison tunnel project.

The government has taken over all the ditches taking water from the Uncompahgre river, except the Ironstone ditch, which for various reasons has stood out and refused to deal with the Reclamation Service. Owing to the fact that there is a large amount of water conveyed from the Gunnison river by the Gunnison tunnel to the Uncompahgre river, it has in a large measure increased the amount of water in the lower Uncompahgre by return water from irrigation. As this return water, or a large part of it, comes into the Uncompahgre river too far down the river for the government people to use it, and as the headgate of the Ironstone ditch is located on the lower Uncompahgre, the water commissioner supplied the decree of the Ironstone ditch with this water, and also some additional water was allowed to flow into the Ironstone ditch. Mr. Pease, the engineer in charge, claims that, inasmuch as they are responsible for the large amount of return water, they are entitled to it; while the water commissioner claims that, when the water gets into the public stream—viz., the Uncompahgre river—it belongs to the stream, and as such the Ironstone ditch is entitled to the water.

The engineer, Mr. Pease, then ordered the headgate of the Gunnison tunnel closed. This called forth such a unanimous and vigorous protest from the water-users that Mr. Pease reopened the headgate of the tunnel. The dispute will probably have to be settled in the courts.

A large number of the reservoirs at the head-waters of Surface and Forked Tongue creeks formed an association for the purpose of consolidating all the reservoirs in that locality into one large company, to be known as the Surface Creek Water Users' Association. The association was formed for a period of three years, and, if it works successfully, at the end of that time all the reservoir companies will be consolidated into one large company.

The ends to be attained are the conservation of water, lessening the expense of distribution, and increasing the availability and usefulness of the water.

Some of the owners of reservoirs on Grand mesa complained to your office about the safety of several reservoirs. Their letter of complaint, together with your answer, is given below.

"State Engineer, Denver, Colorado.

Dear Sir: Owing to the fact that the dam of one certain reservoir, known as the Military Park reservoir, sprung a leak last season, and the water from same rushed down into the Park reservoir, causing some damage to the latter reservoir, and endangering persons and property along Surface creek;

And also owing to the fact that we are informed that the said Military Park reservoir has not been repaired; and

Owing to the fact that the Greenwood reservoir was in a leaky condition last season, and we are informed that the same has not been properly repaired; we, therefore, request that you as State Engineer, under authority of section 3,209, investigate the condition of the reservoirs above referred to, and take such steps as in your judgment are necessary to protect property and the public welfare.

Respectfully yours,

A. J. BROOKBANK.
H. K. FERGUSON.
A. H. STOCKHAM.

Eckert, Colorado, February 8, 1912."

"Denver, March 8, 1912.

Mr. H. C. Getty, Irrigation Division Engineer, Division No. 4, Delta, Colorado.

Dear Sir: I enclose herewith a letter from Mr. A. H. Stockham and others, which will explain itself. I have written Mr. Stockham that this reservoir, together with others, will be examined during the coming season, as soon as weather and other conditions will permit. In the meantime, will you make such investigation and take such steps as may be possible at this season of the year?

Yours truly,

CHARLES W. COMSTOCK,
State Engineer."

"Denver, Colorado, October 14, 1912.

State Engineer, Capitol Building, Denver, Colorado.

Dear Sir: Accompanied by Mr. H. C. Getty, Irrigation Division Engineer, Division No. 4, I made an inspection of a large number of reservoirs on the Grand mesa, north of Delta, Colorado, from September 22 to September 29, and desire to make the following report:

There are a large number of reservoirs, possibly two hundred, located on the Grand mesa on the head-waters of Surface creek and its tributaries. These reservoirs supply water to the lands located in the valley from Cedaredge to Delta and vicinity.

The greater number of these reservoirs are very small, having a capacity of from ten to 100 acre-feet. A small number of them are of fairly good size, the largest holding about 3,000 acre-feet of water.

Some of the dams of these reservoirs have been built for ten or fifteen years, and some uneasiness was felt and some complaint made by property-owners, both to the State Engineer and to the Division Engineer, as to their condition.

While most of these reservoirs hold such a small quantity of water that no great damage would be done by the failure of one alone, their location is such that the failure of one dam might involve the failure of several others lower on the stream, and the accumulated water would cause considerable damage.

In some cases there are eight or ten reservoirs on one stream. If failure should occur in the upper dam of such a chain, especially when all the reservoirs were entirely filled, the relieved water might easily cause the failure of each dam in succession. In such a case the actual damage to property in the valley might be large, in addition to the reservoirs and the loss of water.

As these dams are all very similar, I do not think it necessary to give a detailed description of each one we visited. A description of the general type will be sufficient, except in one or two cases, which will be mentioned later.

The reservoirs examined were the Surface Creek Ditch and Reservoir Company's system, as follows:

Alexander;
Deep Ward;
Deep Slough;
Sheep Slough;
Island;
Mat Arch;
Twin Forest;
Baron;
Big Eggleston;
Little Eggleston;
Donnelly;
Kennicott;
Kiser.

Then the following:

Trickle Park;
Military Park;
Young's Creek Reservoirs Nos. 1, 2, and 3;
Cedar Mesa;
Bonita;
Kehmeyer;
Weir and Johnson;
Leon Park;
Leon Lakes;
Y. & S.

The dams are built across the natural stream-bed, and are either of earth or earth and rock combined. Where plenty of rock was available, a heavy wall was built on the down stream side. This makes a good distribution of the material and lessens the quantity that would be necessary if flatter slopes were used, as would be imperative with dirt alone. When rock is not used, the lower slope is usually very steep, 1½ or, at most, 2 to 1.

The crests are uniformly narrow, few being twelve feet in width.

The inside slopes vary from 2 to 1 up to 3 to 1. Most of them are unprotected, some few being protected by rock riprap.

Spillways are uniformly small, shallow, and entirely inadequate. They are made by cutting a narrow trench through the natural ground, so as to lead the overflow away from the dam. They are entirely too shallow, being on an average of three or four feet below the crest line. Some few of the larger dams have five feet freeboard, but this is exceptional. They are also too narrow, and the sides of the cuts are too steep. Only in a few cases has any attempt been made to protect the cut from washing in case of flow through spillway, and then only to a slight extent.

The outlets are wooden boxes, provided with wooden or steel gates at the intake ends. The gates are ordinarily lifted by a vertical wooden stem operated from a tower reached by a wooden foot bridge. These gates are clumsy and cannot be operated rapidly and easily, as they should.

The formation and movement of ice has caused some trouble with these gate towers, and a few gates are now being set so that they can be operated by a stem inclined along the inner slope, and operated from the crest of the dam. These new lifting devices are not entirely satisfactory as they are clumsy and crude.

The material of which the dam is composed is usually good. It is for the most part sandy clay with more or less gravel. It compacts well and stands the ordinary wear and tear of weather in a satisfactory manner.

I wish to call attention to the Leon Park reservoir dam as being in an exceptionally unsatisfactory condition. The material in this dam is a disintegrated shale of a peculiar white color. The height of the dam is twenty-nine feet; inside slope, 2 to 1; outside slope, 1 to 1; crest, roughly six feet. Spillway is open cut around one end, four feet wide and five feet below crest. Slopes are not true and apparently no attempt was made to keep them regular. The outlet is an eight inch square wooden box which is entirely incapable of carrying the ordinary spring run-off.

This outlet should be enlarged at once, as under present conditions it is impossible to prevent storing water. The dam should then be practically reconstructed along proper lines and after proper approval of plans.

All of these dams should be modified to meet, at least, the following conditions:

(1) Crest should be not less than sixteen feet.

(2) Freeboard not less than five feet.

(3) Spillways not less than fifteen feet wide, with flat side slopes, and bottom paved with rock laid carefully. While this spillway is small, the drainage area above the reservoir is small, and this area of spillway will be ample in most cases.

(4) Inside slopes should be flattened to 3 to 1 and, if necessary, riprapped.

(5) Outside slopes should be at least 2 to 1 or have a heavy rock wall.

(6) Outlets should be capable of carrying the ordinary spring floods. Gates should be of steel and provided with an efficient operating device capable of opening or closing the gates in a short time.

As cold weather has already set in, it will be impossible to do this work before next summer. However, arrangements should be made to start work as early as possible, and have all the dams in a satisfactory condition by the middle of September.

Respectfully submitted,

J. W. JOHNSON,
Deputy State Engineer."

While the water commissioners in this division have distributed the water of the districts in an able and intelligent manner, I am sorry to say that their reports are generally incomplete, which makes any tabulation of statistics very difficult.

There are no reports from Districts Nos. 28, 29, 31, 32, 59, 63, and 69.

District No. 30—S. M. Campbell, Durango, water commissioner: Mr. Campbell reports the use of about 50,000 acre-feet of water which was used to irrigate the following crops:

CROP REPORT

	Acres	
Alfalfa	9,537	
Natural grasses	460	
Cereals	3,115	
Orchards	620	
Potatoes	40	
Total		13,772

District No. 33—C. E. Allen, Durango, water commissioner: The report from this district is very incomplete. There are no data as to the amount of water used, and the crop report includes one ditch only. He reports a general scarcity of water and the need of reservoirs in the district.

District No. 34—Thomas A. Fielding, Mancos, water commissioner: Mr. Fielding was appointed late in the season, and his crop report was obtained under much difficulty. It includes those ditches taking water from the Rio Mancos and the Dolores river. While the report is not complete, he gives the following statistics:

Number of priorities	59
Amount of appropriations (second-feet)	1,486
Capacity of canals (incomplete—second-feet)	962
Length of canals (miles)	95
Average number days water was used	68
Average daily amount carried (second-feet)	400
Number acres that can be irrigated	67,635

CROP REPORT

	Acres	
Alfalfa	11,880	
Natural grasses	1,070	
Cereals	11,817	
Orchards	1,813	
Potatoes	666	
Total		27,246

Cost of repairs	$205.30
Improvements	65.25

District No. 40—D. S. Doughty, Delta, water commissioner:

Number of priorities	319
Capacity of ditches (second-feet)	573.5
Length of ditches (miles)	178
Average number of days water was carried	56
Average daily amount carried (second-feet)	506

CROP REPORT

	Acres	
Alfalfa	11,897	
Natural grasses	4,919	
Cereals	3,334	
Orchards	8,139	
Market gardens	794	
Potatoes	545	
Sugar beets	212	
Other crops	33	
Total		30,173

This does not include the Gunnison river or the North Fork of the Gunnison, where the commissioner was not needed.

The commissioner was called out about April 1, and worked until November 1. He employed fourteen deputies on the following creeks: Dough Spoon, Oak, Dirty George, Forked Tongue, Ward, Young's, Surface, Leroux, Terror, Hubbard, Muddy, Minnesota, Crystal, Little Clear, and the Smith Fork of the Gunnison river.

The district lies in four counties; viz., Delta, Montrose, Gunnison, and Mesa.

The counties of Gunnison and Mesa derive very little, if any, benefit from the service of the water commissioner, and it seems an act of injustice to compel them to pay one-half of the heavy expense of distribution in this water district.

District No. 41—A. J. Baxter, Montrose, water commissioner: This district is along the lower Uncompahgre river and includes the land under the Gunnison tunnel project. The most important ditches have been taken over by the United States government.

The commissioner sends in the folowing report:

Capacity of canals (second-feet)	1,574
Length of canals (miles)	190
Length of laterals (miles)	406
Average daily amount carried (second-feet)	483
Number acres that can be irrigated	72,760

CROP REPORT

	Acres	
Alfalfa	18,020	
Natural grasses	1,890	
Cereals	11,770	
Orchards	5,180	
Market gardens	4,800	
Potatoes	7,980	
Sugar beets	4,630	
Other crops	2,550	
Total		56,820

COST

Superintendence	$1,600	
Repairs	8,650	
Improvements	3,500	
Total		$13,750

District No. 42—George M. Saunders, Mesa, water commissioner: This report covers only that portion of the district where the services of the commissioner were required, and does not include the Grand valley. The commissioner put in 103 days, and had six deputies, who averaged about sixty days each, making the total cost of distribution for the district $1,657.50.

The report on crops, etc., is as follows:

Number of priorities	53
Amount of appropriations (second-feet)	364
Average daily amount carried (second-feet)	194
Number acre-feet used	33,144

CROP REPORT

	Acres	
Alfalfa	11,934	
Natural grasses	788	
Cereals	2,492	
Orchards	850	
Market gardens	45	
Potatoes	379	
Sugar beets	36	
Other crops	71	
Total		16,595

This report shows a duty of water of two acre-feet per acre.

There were about 5,438 acre-feet of reservoir water used during the season.

District No. 60—H. C. Browning, Norwood, water commissioner: The report from this district is given by taking each canal separately, there being three canals and several small ditches. For the Curley ditch, owned by the San Miguel Irrigation and Land Company, I obtain the following facts:

Amount of appropriations (second-feet)	62.5
Capacity of canal (second-feet)	95
Length (miles)	43
Length of laterals (miles)	20
Daily amount of water used (second-feet)	26

About 7,956 acre-feet of water was used.

There are about 30,000 acres of land under this canal, 4,460 acres of which were in the following crops:

	Acres	
Alfalfa	2,300	
Cereals	1,600	
Orchards	350	
Market gardens	90	
Potatoes	70	
Other crops	50	
Total		4,460

About 30,000,000 cubic feet of reservoir water was used by the company this season. The duty of water was about 1.8 acre-feet per acre.

The company spent about $1,300 in improvements and repairs.

The Lone Cone canal has an appropriation of 22 second-feet. The capacity of the canal is 55 second-feet; length, 25 miles; length of laterals, 16 miles. The average daily amount of water used by the canal is 28 second-feet. 4,704 acre-feet of water was used during the season.

There are about 20,000 acres of land under this canal, 2,100 of which were irrigated this season.

CROP REPORT

	Acres	
Alfalfa	1,100	
Cereals	870	
Orchards	6	
Market gardens	30	
Potatoes	50	
Other crops	44	
Total		2,100

The duty of water was about 2.3 acre-feet per acre. The owners, the Lone Cone Ditch and Reservoir Company, completed a reservoir this season of 77,000,000 cubic feet capacity.

The Colorado Co-operative Company's canal has an appropriation of 60 second-feet; capacity, 60 second-feet; length of canal, 17 miles; length of laterals, 20 miles; average daily amount of water used during the season, 45 second-feet. The number of acre-feet used was 10,620, which was used on 5,220 acres of land. This gives a duty of water of about two acre-feet per acre.

The crops grown were:

	Acres	
Alfalfa	1,250	
Natural grasses	200	
Cereals	1,400	
Orchards	900	
Market gardens	850	
Potatoes	120	
Other crops	300	
Total		5,020

The total number of acres under this canal is 10,000. The company spent $4,000 in repairs and improvements. The commissioner reports about 1,500 acres of land under various small ditches.

District No. 61—W. S. Jones, Paradox, water commissioner: The report from this district is complete in every respect, and is by far the most satisfactory report from any district in this division. Mr. Jones also supplied this office with weekly reports the entire season. The report is as follows:

Number of priorities	20
Amount appropriated (second-feet)	16.61
Capacity of canals (second-feet)	42
Length of canals (miles)	195
Length of laterals (miles)	10
Average number of days water was carried	92
Average daily amount used (second-feet)	13.89
Number of acre-feet used	2,573
Total number of acres that can be irrigated	1,965

CROP REPORT

	Acres	
Alfalfa	612	
Natural grasses	187	
Cereals	288	
Orchards	32	
Potatoes	9	
Other crops	25	
Total		1,153

The duty of water was about 2.2 acre-feet. $674 were spent for repairs. There are several reservoirs being constructed in the district.

District No. 62—W. O. Brower, Cimarron, water commissioner: This district lies in three counties; viz., Gunnison, Hinsdale and Montrose; and Montrose county refuses to pay for any portion of the commissioner's salary. Unless some arrangements are made whereby the commissioner will receive his pay, this district is likely to be without a commissioner. As Mr. Brower puts in only such time as is absolutely necessary, his report is not complete, but is as good as could be expected under the circumstances. He sends in the following crop report, which is incomplete:

	Acres	
Timothy	874	
Natural grasses	103	
Potatoes	10	
Total		987

District No. 68—John W. Martin, Ridgway, water commissioner: This district is on the upper Uncompahgre river, and as the district is well supplied with water, the commissioner's services were needed for a short time only. The crop report is very complete, and is as follows:

	Acres	
Alfalfa	2,030	
Natural grasses	1,702	
Cereals	3,295	
Orchards	119	
Market gardens	48	
Potatoes	290	
Sugar beets	94	
Mixed hay	5,710	
Timothy	1,150	
Total		14,438

Cost of operating and superintendence	$4,883.00	
Cost of repairs	2,658.00	
Cost of improvements	600.00	
Total		$8,141.00

By an Act of the last General Assembly, this office was located at Montrose, Colorado; but as the General Assembly failed to make an appropriation for that purpose, the Secretary of State has been unable to comply with the statutes in this instance. Hence the office has remained at Delta, Colorado. I would respectfully recommend that an appropriation for the purpose of establishing and maintaining this office at Montrose be made by the next General Assembly.

In this division there is general dissatisfaction in regard to the way the water commissioners are paid. Some counties refuse to pay for any services of the water commissioner whatever, and consequently it is hard to get competent men to accept the position of commissioner when they will be unable to obtain their pay unless they resort to the courts, which is expensive and unsatisfactory, to say the least.

The crops generally throughout the division were excellent, hay and grain being especially good. While the fruit crop was very heavy, the prices received were very disappointing. The price received for the potato crop was also low.

In closing this report, I desire to thank the water commissioners of the entire division for their interest in the work of distribution and their hearty co-operation with this office.

Very respectfully submitted,

[Signed] H. C. GETTY,

Irrigation Division Engineer, Division No. 4.

ANNUAL REPORT OF IRRIGATION DIVISION ENGINEER, DIVISION No. 5, FOR 1911

Glenwood Springs, Colorado, November 30, 1911.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit my annual report for the irrigation season of 1911, in Division No. 5.

The water supply was, on the whole, satisfactory and little trouble was experienced in the distribution of water, except on Rifle creek, where the owners of the Davie ditch, the headgate of which is located about nine miles above the mouth of the creek, desired to exchange water by pumping the needed quantity from the Grand river into Rifle creek at a point a short distance above the headgate of the Pioneer ditch, which is the last ditch on the creek and has the first priority of water right.

The intervenors, whose headgates are located between those of the Davie and the Pioneer ditches, protested on the ground that the appropriation by such exchange would injure them.

Your instructions to me on this subject were further supplemented by your findings, after a hearing in your office, where all parties of interest were represented, and in compliance therewith the exchange was made.

At this writing the owners of the Davie ditch have presented their petition for adjudication in the district court, and the parties adversely interested have filed their protest. The findings of the court not yet having been made, I forego further observations on this case.

In many cases I have noticed that proper regulation of supply has resulted, as it should, in more economical use of the water for irrigation without shortage of crops where such was apprehended; but, on the contrary, such crops have proven to be satisfactory.

I have also noticed that, whether or not the question of supply was raised, the authority of the irrigation officials has been exercised to good effect and, with one exception, has not been questioned.

This exception refers to District No. 39, where a hearing has been asked with charges of incompetency and injustice against the water commissioner. On account of severe sickness on his part, I could not proceed with the hearing, and have postponed it to some day during December.

Some confusion was caused by the delay in the appointment of the commissioner in District No. 45, where the person in question assumed jurisdiction upon his being recommended for appointment and before the same was made by the Governor; but no damage was done as I had time to direct matters satisfactorily.

The visible waste of water—especially upon the public roads—has been checked to a large extent during this season.

Wherever recalcitrancy occurred in such cases, the water was shut down in short order and the lesson was heeded.

The commissioners of the counties where such waste was observed aided the irrigation officials by issuing notices through the sheriff, and this co-operation proved beneficial.

The potato crop was noticeably damaged throughout this division during 1911 on account of some unknown disease, presumed to be a blight of uncertain origin and character. I estimate the loss from this cause to be approximately 40 per cent. The quality remained almost unimpaired. On measured areas up to 17.50 acres, crops of 16.50 tons per acre were reported. Two of such acres I measured personally.

Grain and hay grass gave excellent crops. On a measured area of 119 acres, 684 tons of alfalfa were realized. On 63 acres, 384 tons of alfalfa were raised. A measured area of 8.50 acres yielded 1,054 bushels of oats at 40 pounds; another plot of 35 acres yielded 3,185 bushels of like weight.

Numerous other instances of such harvests could be added, but the above have come under my personal observation.

The fruit crop was not as anticipated, though only a few instances of smudging east of Parachute creek are reported.

Sugar beets have increased in area but not as much as was expected.

Rotation of crops would prove beneficial in some localities. This and the necessity for better alignment, better side slopes, uniform grading and the securing of water-tight beds of ditches by the use of good lining material, all in order to prevent avoidable loss by seepage and evaporation, can only be recommended but will perhaps remain desiderata only as long as some consumers are either unable or unwilling to improve upon existing conditions.

Of projected storage plants, the Spring Park reservoir construction in Township 7 South, Range 87 West 6th P. M., with a supply of over 15,000 acre-feet, has been taken up of late by the interested parties, and I learn that deeds for the patented land forming the reservoir site have been placed in escrow by the owners.

The construction of the canal of the Development and Mines Company out of Elk creek was stopped for the winter after considerable work had been done during the past season. This project, when completed, will furnish irrigation for over 25,000 acres.

The dam of the Antlers reservoir is nearly finished and will be completed within this month if the weather permits. The engineer in charge, Mr. A. G. Allan, has installed an automatic clock record of the flow of East Rifle creek, from which he plotted a hydrograph of the creek, the Antlers canal and reservoir, and of the domestic supply; and this has been used in preparation of part of this report. The device was also employed in my regulation of the creek last season.

The dam of the Park reservoir on West Elk creek, constructed by the West Elk Land and Live Stock Company, was completed last June, and the storage thereby created furnishes irrigation for about 200 acres.

The same company contemplates construction during 1912 of the Goldsborough reservoir—in the Mud Spring Basin—T. 3 S., R. 92 W., to be fed by North Elk creek and the Mud springs.

The Mamm creek reservoirs, the High Line canal from Rock creek in Pitkin county to the Hunter mesa, southeast of the town of Rifle, and some other projects of a like character have not advanced beyond the inceptive stage.

With the abundance of water in the rivers and streams of Division No. 5, the average agriculturist does not feel like paying for perpetual irrigation rights more than from $35 to $50 per acre; although hundreds of thousands of acres of good, arable land wait for development and reclamation by well-studied projects by means of which irrigation could be furnished within the above figures.

In relation to reports from the various water commissioners I have to state:

F. J. Huntington, commissioner, District No. 50, reports that he had no occasion to adjust any disputes, and that he has not been called out during the last season; that he has served notice on thirty-nine consumers to place headgates and measuring devices, or either, in their ditches. He reports no acreages and gives no other notes on water supply, capacities, recorded claims, etc., for reasons given elsewhere.

Commissioners Rundell, District No. 52; Henry Page, District No. 53, and E. W. Leggett, District No. 54, have sent in no reports whatever.

Commissioner Hutchinson, District No. 58, reports settlement of one dispute in answer to my letter of instructions on that subject, and states that other instructions I gave him—as, for instance, the estimating of irrigated areas—could not be complied with on account of the reluctance of the county commissioners to pay for his time consumed in such and kindred work.

Commissioner Newton, District No. 70, states that he received the field books on the 3rd instant; that he is now preparing his annual report but cannot complete it before the 9th instant.

In connection with the above notes, permit me to state:

Some time in September, 1911, I instructed all water commissioners in my division to summarize the notes in their field books in such form as to enable them to prepare their annual reports in time and in acceptable shape.

I received answers from some of the commissioners, voicing the sentiment that the respective boards of county commissioners should be made to feel the urgent necessity of providing for compensation for work not directly involved in calls from consumers alone.

It appears from all I can learn that your recommendations for legislative measures in this matter form the only remedy for the present state of affairs in relation to stated duties and compensation of water commissioners, and more especially regarding the mode of their appointment.

Unfortunately, your own view and suggestions on this subject, as laid down in the biennial report of 1909-1910, page 18, under the caption "Water Commissioners," and later on embodied in a senate bill, were not acted on by the last General Assembly—perhaps under the influence of outside, untimely and ill-advised opposition which combatted the plan to make the water commissioners subject to direct appointment by the Governor, and to pay them in salaries direct from the state treasury.

This opposition was apparently founded on the alleged undue financial burden which the City and County of Denver would have to bear in the shape of overtaxation for the benefit of the balance of the state, when, as further alleged, Denver has no irrigation interests.

The character of such argument needs no further comment than the plain statement that the per capita tax for Denver would be 20 cents per annum in support of an industry which yielded over $163,000,000 for the year 1910, and which aids most materially in the growth and prosperity of Denver.

As long as the boards of county commissioners consider irrigation of not enough importance to pay for the gathering of statistics on areas and crops, it either devolves on the division engineer to go into the various districts and survey several hundred thousand acres inside of six weeks, or the commissioners cannot send in their reports.

Lastly, I cannot refrain from noting that the ever-recurring differences between two owners of water rights out of Berry Creek, District No. 37, which have in the past caused litigation and ill-feeling, have subsided, at least for this season.

I mention this case as one of notable rarity. The respective quantities involved are 0.08 and 0.14 cubic second-feet, and the litigation so far has caused expenses of more than $1,500. When applied to value of water rights, the resulting figure—$6,818.10 per cubic second-foot—appears rather startling to Eagle county irrigators.

Water District No. 37

Appropriation to ditches (cubic second-feet)	371.40
Capacity of ditches (cubic second-feet)	497.40
Length of ditches (miles)	74.50
Length of laterals (miles)	9.12
Water used from April 20 to September 18	......
Average number of days of use of water	67.60
Average cubic feet per second of water during season in ditches	314.20
Total acre-feet of water during season in ditches	44,209.00
Total irrigated area (acres)	16,598.00
Total area that can be irrigated (acres)	22,420.00
Duty (acre-feet per acre)	2.65

CROP REPORT

	Acres	
Alfalfa	10,240	
Natural grasses	3,173	
Cereals	1,659	
Potatoes	1,206	
Miscellaneous	320	
Total		16,598

Water District No. 38

Appropriation to ditches (cubic second-feet)	402.00
Capacity of ditches (cubic second-feet)	691.00
Length of ditches (miles)	293.40
Length of laterals (miles)	43.00
Water used from April 21 to September 29	......
Average number of days of use of water	72.00
Average cubic feet per second of water during the season in ditches	412.00
Total acre-feet of water during season in ditches	59,000.00
Total irrigated area (acres)	26,000.00
Total area that can be irrigated (acres)	26,208.00
Duty (acre-feet per acre)	2.27

Water District No. 39

Appropriation to ditches (cubic second-feet)	928.17
Capacity of ditches (cubic second-feet)	531.50
Length of ditches (miles)	233.60
Length of laterals (miles)	69.50
Water used from April 1 to November 1	......
Average number of days of use of water	148.00
Average cubic feet per second of water during season in ditches	190.70
Total acre-feet of water during season in ditches	56,257.00
Total irrigated area (acres)	34,345.00
Total area that can be irrigated (acres)	57,814.00
Acre-feet used by reservoirs	1,450.00
Average duty (acre-feet per acre)	1.68

The combined duty in acre-feet per acre under the Antlers canal and reservoir of the Antlers Orchard Development Company is 2.10.

Discharge of Antlers canal (acre-feet)	5,455.00
Reservoir discharge (acre-feet)	1,450.00
Water duty from canal alone (acre-feet per acre)	1.62
Water duty from reservoir alone (acre-feet per acre)	0.48

CROP REPORT

	Acres	
Alfalfa	7,606.75	
Natural grasses	17,201.75	
Cereals	3,375.25	
Orchards	3,476.50	
Market gardens	303.75	
Potatoes	1,560.50	
Sugar beets	759.50	
Miscellaneous	61.00	
Total		34,345.00

WATER DISTRICT No. 43

Appropriation to ditches (cubic second-feet)	588.04
Capacity of ditches (cubic second-feet)	341.00
Length of ditches (miles)	261.40
Water used from April 22 to September 4	......
Average number of days of use of water	73.00
Average cubic feet per second of water during season in ditches	368.00
Total acre-feet of water during season in ditches	75,060.00
Total irrigated area (acres)	25,610.00
Total area that can be irrigated (acres)	59,000.00
Duty (acre-feet per acre)	2.93

CROP REPORT

	Acres	
Alfalfa	10,946	
Natural grasses	10,445	
Cereals	3,340	
Orchards	20	
Potatoes	104	
Sugar beets	9	
Miscellaneous	746	
Total		25,610

WATER DISTRICT No. 44

Appropriation to ditches (cubic second-feet)	448.43
Capacity of ditches (cubic second-feet)	519.26
Length of ditches (miles)	186.00
Length of laterals (miles)	21.40
Water used from April 1 to September 12	......
Average number of days of use of water	66.50
Average cubic feet per second of water during season in ditches	171.47
Total acre-feet of water during season in ditches	22,805.00
Total irrigated area (acres)	7,983.00
Total area that can be irrigated (acres)	23,155.00
Duty (acre-feet per acre)	2.86

CROP REPORT

	Acres	
Alfalfa	3,290	
Natural grasses	3,385	
Cereals	1,277	
Potatoes	31	
Total		7,983

WATER DISTRICT No. 45

Appropriation to ditches (cubic second-feet)	591.00
Capacity of ditches (cubic second-feet)	373.40
Length of ditches (miles)	331.00
Length of laterals (miles)	97.40
Water used from April 15 to October 30	.....
Average number of days of use of water from ditches during season	67.00
Average number of days of use of water from reservoirs during season	29.00
Average cubic-feet per second of water from ditches during season	361.00
Total acre-feet of use of water from ditches during season	48,370.00
Total irrigated area (acres)	23,697.00
Total area that can be irrigated (acres)	40,190.00
Duty (acre-feet per acre)	2.06

CROP REPORT

	Acres	
Alfalfa	12,092	
Natural grasses	1,865	
Cereals	5,913	
Orchards	1,772	
Market gardens	150	
Potatoes	994	
Sugar beets	179	
Miscellaneous	732	
Total		23,697

The supply from reservoirs in this district is included in above, since the reservoirs feed most of the ditches accounted for. Total capacity of reservoirs in District No. 45, 1,149 acre-feet.

WATER DISTRICT No. 52

Appropriation to ditches (cubic feet per second)	59.10
Capacity of ditches (cubic feet per second)	78.25
Length of ditches (miles)	54.25
Length of laterals (miles)	26.75
Water used from May 13 to October 1:	.....
Average number of days of use of water	86.00
Average cubic feet per second during season in ditches	60.57
Total acre-feet	6,348.30
Total irrigated area (acres)	2,685.00
Total area that can be irrigated (acres)	4,478.00
Duty (acre-feet per acre)	2.90

CROP REPORT

	Acres	
Alfalfa	432	
Natural grasses and timothy	1,482	
Cereals	743	
Potatoes	27	
Market gardens	1	
Total		2,685

WATER DISTRICT No. 70

Appropriations to ditches (cubic feet per second)	152.50
Capacity of ditches (cubic feet per second)	249.50
Length of ditches (miles)	105.50
Length of laterals (miles)	43.00
Water used from May 1 to October 30	.....
Average number of days of use of water	62.00
Average cubic feet per second during season in ditches	105.67
Total acre-feet	13,102.00
Total irrigated area (acres)	3,917.00
Total area that can be irrigated (acres)	11,429.00
Duty (acre-feet per acre)	3.34

CROP REPORT

	Acres	
Alfalfa	2,239	
Natural grasses	87	
Cereals	764	
Orchards	340	
Market gardens	4	
Potatoes	70	
Sugar beets	221	
Other crops	192	
Total		3,917

WATER DISTRICT No. 70

RESERVOIRS

	Number
Fed by Dry Fork	2
Fed by Clear creek	2
Fed by Brush creek	1
Fed by Carr creek	1
Fed by Kimball creek	3
Fed by Mud springs	1
Fed by surface water	1
Fed by Roan creek	2
Fed by Sulphur creek	1
Fed by Con creek	1

High-water line areas, from 1 to 40 acres.

Three were dry during the entire season.

Two have leaky dams.

Two have broken dams.

One is filled with dirt.

In two others, water sinks and keeps up supply of Clear creek; one is used as an ice pond.

Capacities, from 200,000 to 2,000,000 cubic feet.

Dams are from 5 to 10 feet high above bottom of outlet.

Two were kept filled from May 1 to November 1 with 86,000 and 696,960 cubic feet of water, respectively.

Three are reported in good condition; one ditto, but with the saving clause that "the water sinks." One is reported "bad;" one with a washed-out spillway, and another one suffers from a "feeder ditch broke."

Spillways are from 6 to 20 feet wide, and outlets from 8 to 100 square inches.

This district evidently does not depend on storage waters to any noticeable extent, a fact which is further emphasized by the water duty of 3.34 acre-feet furnished by direct irrigation.

ANNUAL REPORT OF IRRIGATION DIVISION ENGINEER, DIVISION No. 5, FOR 1912

Glenwood Springs, Colorado, November 30, 1912.

State Engineer, Denver, Colorado.

Dear Sir: I herewith submit my annual report for the irrigation season of 1912.

Water was abundant throughout the division and season, and several commandments were broken by sopping-wet irrigators on account of the spring rains. In fact, it kept raining almost all season, and if it had not been for the unrequited love for strife, so innate in some people, no dispute of any kind would have taken place. The only trouble experienced in this respect, which finally was settled in the court, was caused by too much water in a case on Mamm creek and near the mouth thereof.

It appears that one party had permission from his neighbor to dam up the creek at a certain point and lead it through the latter's premises in an artificial channel. This channel was constructed, but only partly, and in consequence the low-lying portion of the grantor's land was flooded and covered with silt and mud. I warned the aggressor and gave him notice to desist, also to secure the banks of his new channel, but youth heedeth not, and the end of it was an injunction suit which was decided in favor of the grantor.

A change of ditch in a privately settled case, Curtis and Martin vs. Heuschkel, was beneficially effected and all parties seemed to be satisfied.

The protests by consumers on Rifle creek against an exchange of supply and diversion by Davie & McLearn was settled by your instructions. The exchange was effected without damage to anyone, and the Davie ditch

received a decree in the district court. While the matter was yet pending, the Rifle creek irrigators, with only a few exceptions, preferred charges against the water comissioner in District No. 39, for having been unduly influenced to distribute the waters of the creek dishonestly; for insubordination; for failure, neglect and refusal to comply with your orders; for failure, neglect and refusal to distribute the water of Rifle creek in accordance with decrees; and for being incompetent and not qualified to fulfill his duties as water commissioner. Having never previously presided at court, with all of its paraphernalia, with two full-grown lawyers in attendance, and several dozen witnesses ready to do their part, this deponent felt, to say the least, as small as a mouse. But, determined to go to the bottom of this matter, I passed the ordeal and for three successive days filled the judicial chair to my entire satisfaction. Carefully weighing the testimony, comprising 588 typewritten folios, and having taken notes personally during the hearing, I acquitted the water commissioner of the charges. What spirit moved some of the plaintiffs may be gathered from the fact that I was afterwards accused of having prejudged the case for a monetary consideration. To comment on this is impossible, but I transmitted my findings to you, and, as you did me the justice, not only to approve of, but to commend me for it, I feel reasonably assured that I have acted justly and fairly in this case.

I transmitted instructions to the various water commissioners for the enforcement of Chapter 153, Session Laws of 1911, in relation to headgates with locks and keys, measuring devices, waste-gates and gauge rods, and no complaints on the subject were received.

Water waste from Rifle creek ditches, damaging one consumer on Grand river, was checked.

All crops were abundant, but orchards suffered from lack of labor, and hundreds of tons of fruit, especially apples, were left unpicked on the trees, or the fall yield was fed to the stock.

The Antlers reservoir dam was completed and you inspected and approved of the construction.

The Spring Park reservoir dam is also apparently completed.

Some large projects in Routt and Rio Blanco counties are yet in their inceptive stage.

The commissioners in Water Districts Nos. 43, 44, 52, 53, and 54 have failed to send in reports; probably because there were no contentions, or because the county commissioners refused, as is usual, to pay for the time necessary to take measurements of areas and classify crops.

After corresponding for two years with the clerk of the district court in Breckenridge, for the purpose of obtaining decrees in Water District No. 36, I find that the county commissioners do not approve of incurring expenses for that purpose. In District No. 36 there is no water commissioner, and the irrigation official who attempts to adjust disputes there has no means of enforcing the law.

A case of violence in District No. 45, where the deputy water commissioner was assaulted in the discharge of his duty, is the subject of court proceedings which have not terminated at this time.

The Willcox canal, in District No. 39, is completed. It takes its supply from the Grand river, near the town of Rifle, and supplies the land comprised in the Grand Valley Irrigation District, in Garfield county, on the north side of the Grand river for a length of twenty-eight miles, to a point about nine miles west of Grand Valley. The district comprises 6,750 acres of irrigable land. The canal has priorities of 300 and a capacity of 108 cubic feet per second, with a length of 41,500 feet to a point where the water is used for a pumping station to raise water for the irrigation of 500 acres in two elevations of 110 feet each. Each pumping unit consists of a fourteen-inch, two stage Alberger turbine pump, direct-connected to a Samson turbine. For the balance of the length of the canal the capacity is fifty cubic feet per second. The canal throughout is of substantial construction, with reinforced concrete headgate, waste-ways and spillways, combined with sand-traps and sluices. Beneath the Rio Grande Junction railway tracks the water is conducted in a steel-concrete syphon. Hess steel flumes on substantial timber trestles, set upon concrete footings, have replaced the old timber structures. Where new timber flumes have been constructed, they are of redwood, lined with heavy elaterite roofing material.

Cross-drainage has been taken care of by culverts, super-passages and enclosed waterways, of enduring material, and no cross-drainage of consequence is taken into the canal. In the first eight miles of the canal about seventy lineal feet of spillway is provided at normal water surface, which automatically discharges an amount of storm water equal to the capacity of the canal with a rise of 0.6 of a foot in the canal water surface. The officers of the district are Arthur Havemeyer, president, Raymond Havemeyer, and Edwin S. Green, with offices in Grand Valley, Colorado. I enclose some photographs of some of the most notable structures and other features pertaining to the canal.

I speak of this plant at greater length, as its construction offers some notable features not heretofore attempted in this division.

My experience for the past four years has led me to believe that the legislation planned by your office for the betterment and increased efficiency of the irrigation service should be carried into effect. The mode of appointment of water commissioners, as practiced at present, is ineffective. The present status of the deputy water commissioners works out in practice entirely unsatisfactorily, as in some cases the deputy feels that he owes no obedience to the division engineer, since the water commissioner appoints his deputies without regard to the wishes of the division engineer. This leads to unpleasant differences, and the only way to get rid of a deputy water commissioner is to quarrel with the water commissioner himself.

Chapter No. 155 of the Session Laws of 1911, "An act amending the law concerning irrigation division engineers, etc., approved April 4, 1903," discriminates between division engineers in Divisions Nos. 1 and 2 and those in Nos. 3, 4, and 5, in that it raises the salary of the former, while qualifying all five division engineers equally as regards their fitness for the discharge of their duties, and subjecting them to the same examination. At the

same time, all division engineers are forbidden to practice for themselves or to hold any other office. I suggest that steps be taken to have a law passed which affects all division engineers without distinction of location. If the salary of the engineers in Divisions Nos. 1 and 2 has been raised because it is supposed that their time must be devoted to their official duties throughout the year, the proposed legislation should provide for the co-operation of the other division engineers with those in Nos. 1 and 2, after the former have completed their work. It is also not easy to understand why a division engineer should lose his franchise as a citizen, when, for instance, the eventuality arises that a division engineer should be elected to the office of school director, councilman or any other local office, with no, or only nominal, emoluments; nor is it clear to my mind why the state law should forbid a skilled professional engineer or architect, who happens to hold the office of division engineer, to practice in his own time, if it can be done without lessening the efficiency of his state office.

I trust that this matter will be satisfactorily settled during the session of the General Assembly in 1913.

Very respectfully submitted,

[Signed] THEODORE ROSENBERG,

Irrigation Division Engineer, Division No. 5.

WATER DISTRICT No. 37

Appropriations to ditches (cubic feet per second)	394.60
Capacity of ditches (cubic feet per second)	546.20
Length of ditches (miles)	79.92
Length of laterals (miles)	11.40
Water used from May 1 to September 26	......
Average number of days of use of water	65.00
Average number of cubic feet per second during the season in ditches	327.40
Total number of acre-feet during season in ditches	45,200.00
Total irrigated area (acres)	17,488.00
Total area that can be irrigated (acres)	24,610.00
Duty (acre-feet per acre)	2.60

CROP REPORT

	Acres	
Alfalfa	10,800	
Natural grasses	3,320	
Cereals	1,785	
Potatoes	1,300	
Other crops	283	
Total		17,488

WATER DISTRICT No. 38

Appropriations to ditches (cubic feet per second)	432.00
Capacity of ditches (cubic feet per second)	704.00
Length of ditches (miles)	299.00
Length of laterals (miles)	45.80
Water used from April 23 to September 30	......
Average number of days of use of water	83.00
Average number of cubic feet per second during season in ditches	490.00
Total number of acre-feet during season in ditches	63,000.00
Total irrigated area (acres)	27,485.00
Total area that can be irrigated (acres)	29.000.00
Duty (acre-feet per acre)	2.29

CROP REPORT

	Acres	
Alfalfa	11,686	
Natural grasses	4,885	
Cereals	7,240	
Orchards	48	
Market gardens	15	
Potatoes	3,586	
Sugar beets	25	
Total		27,485

RESERVOIRS

Ralston reservoirs Nos. 1, 2, and 3, and Consolidated reservoir: Equities owned by Miller Brothers, Amos and E. W. Ralston, George Coryell; supply from Coulter creek and branches, springs and flood waters; combined capacity, 462 acre-feet; irrigate lands in Townships 6 and 7 South, Range 87 and 88 West; earth dams, 10, 20, 20, and 25 feet high, respectively; outlets, metal tubes, 6, 8, 8, and 10 inches in diameter.

These reservoirs were all filled to their high-water line during the season, leaving inconsiderable quantities at the end of the season, and are being filled during the spring. The outlet of the Consolidated reservoir will have to be repaired before filling can commence; otherwise the condition of this and the other dams is good.

Spring Park reservoir: In Township 7 South, Range 87 West; fed by water from Cattle creek through the Monarch ditch; earth dam 21 feet high above outlet, 1,580 feet long, riprapped on upstream face; equipped with valve tower of concrete; outlet, concrete, 3 feet in diameter; freeboard 6 feet; capacity at 15 feet high-water line, 2,880 acre-feet; first filling not completed; irrigates lands (through uncompleted earth canal) situate westerly of reservoir site.

Smith Park reservoir: Joseph A. Heuschkel, owner; dam 12 feet high above outlet, 320 feet long on crest; earth structure; stone cut-off wall on toe of inner slope; metal outlet pipe 10 inches in diameter; fed by Heuschkel ditch out of Cottonwood creek, and is used for the irrigation of owner's land in Township 7 South, Range 87 West, wherein also the reservoir is located; capacity, 248.8 acre-feet; contained during season 182 acre-feet; all drained at this date.

Hopkins reservoir: Granville A. Hopkins, owner; situate in Township 6 South, Range 88 West 6th P. M., and used for the irrigation of the owner's land in same township; fed by ditches from springs and gulches above reservoir; earth dam with stone core, 25 feet high above 10-inch diameter tile outlet; 450 feet long on crest; spillway 7 feet by 6 feet, with capacity of 170 cubic feet per second; outlet pipe joints in concrete collars; capacity, 119.79 acre-feet; freeboard 5 feet; filled to 15 foot contour; containing 65 acre-feet on May 1; contents November 1, about 1 acre-foot.

WATER DISTRICT No. 39

Appropriation to ditches (cubic feet per second)	971.00
Capacity of ditches (cubic feet per second)	546.00
Length of ditches (miles)	242.00
Length of laterals (miles)	73.00
Water used from May 1 to October 15	.....
Average number of days of use of water	168.00
Average cubic feet per second during season in ditches	224.00
Total acre-feet during season in ditches	74,264.00
Total irrigated area (acres)	35,126.00
Total area that can be irrigated (acres)	58,000.00
Duty (acre-feet per acre)	2.11

CROP REPORT

	Acres	
Alfalfa	7,351	
Natural grasses	17,415	
Cereals	3,535	
Orchards	3,151	
Market gardens	398	
Potatoes	1,784	
Sugar beets	1,440	
Other crops	52	
Total		35,126

RESERVOIRS

Aside from several small reservoirs, too insignificant to report on, this district contains the Antlers, or Grass Valley reservoir, owned by the Farmers' Irrigation Company. It is located in Township 5 South, Range 92 West, about five miles north of Silt station, on the Rio Grande Junction Railroad; takes its supply through the Grass Valley canal from East Rifle creek, and has a high-water area of 159 acres. Its capacity is 174,244,356 cubic feet. The dam is a rolled-earth structure, with a riprapped up-stream face and wave protection; a paved spillway of 100 feet bottom width, and an outlet tube of 24 inches diameter, accessible through a concrete valve tower and controlled by substantial gates. Dam: length on crest, 690 feet; height, 60 feet above bottom of outlet tube, with a free-board of 16 feet. This reservoir furnishes irrigation for about 4,600 acres in the Grass valley near Antlers and Silt, through the Grass Valley canal and its two main laterals and numerous sublaterals. On May 1 it contained 113,256,000 cubic feet and on November 1, 30,492,000 cubic feet. The dam structure, which was examined and accepted by you in January, 1912, is in first-class condition, and the benefits derived from this irrigation plant are shown by increased crops and the abatement of the old-time contention about water diversion, and more economical applications of water.

Water District No. 45

Appropriation to ditches (cubic feet per second)	807.115
Capacity of ditches (cubic feet per second)	496.00
Length of ditches (miles)	361.00
Length of laterals (miles)	104.80
Water used from April 28 to October 12	......
Average number of days of use of water	138.00
Average cubic feet per second during season in ditches	469.71
Total acre-feet during season in ditches	61,804.00
Total irrigated area (acres)	24,546.00
Total area that can be irrigated (acres)	41,712.00
Duty (acre-feet per acre)	2.61

CROP REPORT

	Acres	
Alfalfa	12,938	
Natural grasses	2,178	
Cereals	5,544	
Orchards	1,694	
Market gardens	167	
Potatoes	998	
Sugar beets	234	
Other crops	793	
Total		24,546

RESERVOIRS

Battlement reservoirs: Storing waters of Battlement creek near its head, and of some minor tributaries; owned by the Battlement Water Supply Company; used for irrigation of lands on part of Battlement mesa on the south side of the Grand river, within the drainage area of said creek, in Township 7 South, Ranges 95 and 96 West.

DAMS

No	High Water Area (Acres)	Capacity (Cubic Feet)	Length (Feet)	Height (Feet)	Freeboard (Feet)	Outlet Diameter (Inches)	Contents May 1, 1912 (Cubic Feet)	Contents Nov. 1, 1912 (Cubic Feet)	Protection	Condition
1	14.19	5,733,779	416	30	6	12	5,120,000	950,000	Riprap	Good
2	6.90	2,480,368	175	25	5	10	2,200,000	1,028,000	Riprap	Good
3	41.66	20,011,821	671	30	6	12	18,000,000	1,397,000	Riprap	Good
4	18.75	6,016,700	312	20	5	10	5,400,000	720,800	Riprap	Good
5	5.21	1,453,054	178	20	5	10	1,100,000	219,400	Riprap	Good
6	11.42	2,754,226	420	25	5	10	2,200,000	412,000	Riprap	Good

Water District No. 58

Appropriation to ditches (cubic feet per second)	425.373
Capacity of ditches (cubic feet per second)	694.00
Average number of days of use of water	64.00
Average cubic feet per second during season in ditches	510.00
Total acre-feet during season in ditches	65,280.00
Total irrigated area (acres)	23,545.50
Total area that can be irrigated (acres)	78,000.00
Duty (acre-feet per acre)	2.77

CROP REPORT

	Acres	
Alfalfa	843	
Natural grasses	1,465	
Cereals	5,147	
Orchards	3	
Timothy	15,816	
Potatoes	125.50	
Other crops	146	
Total		23,545.50

RESERVOIRS

The Still Water Reservoir and Ditch Company reservoir, fed by melting snow and springs. Area at high water contour, 96 acres; capacity, 47,916,000 cubic feet; earth dam, 150 feet long on top, 30 feet high above bottom of outlet (16-inch diameter pipe); spillway, 10 feet wide; freeboard, 6 feet; riprapped on up-stream face; fed by Still Water ditch; held on May 1, 1912, 40,000,000 cubic feet, and on November 1, 1912, 28,000,000 cubic feet; condition reported good.

WATER DISTRICT NO. 70

Appropriation to ditches (cubic feet per second)	159.70
Capacity of ditches (cubic feet per second)	244.70
Length of ditches (miles)	101.00
Length of laterals (miles)	4.00
Water used from May 1 to November 1	....
Average number of days of use of water	80.00
Average cubic feet per second during season in ditches	130.00
Total acre-feet during season in ditches	12,807.00
Total irrigated area (acres)	4,273.00
Total area that can be irrigated (acres)	9,798.00
Duty (acre-feet per acre)	3.00

CROP REPORT

	Acres	
Alfalfa	2,453	
Natural grasses	52	
Cereals	888	
Orchards	351	
Market gardens	9	
Potatoes	76	
Sugar beets	306	
Other crops	98	
Within town of DeBeque, miscellaneous	40	
Total		4,273

RESERVOIRS

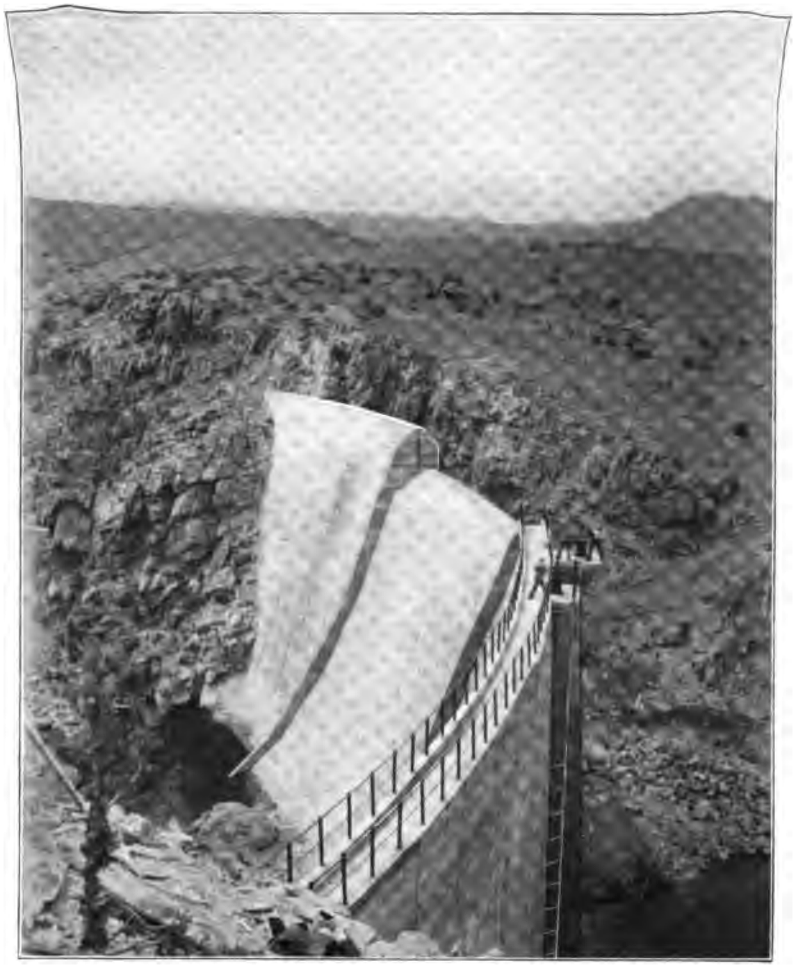
In this district there are fourteen reservoirs; two fed from Roan creek, two from Dry Fork, one from Brush creek, one from Clear creek, three from Kimball creek, one each from Con creek and Carr creek, two from flood waters, and one from Boldt springs.

The high-water areas vary from 1 to 22 acres, and the capacities from 135,000 to 4,356,000 cubic feet. All have earth dams which vary in height from 5 to 30 feet above bottom of outlet, and in length from 150 to 700 feet. In one case a 4-inch tube forms the outlet; in all others the outlets are square, varying from 16 to 168 square inches in area. In two cases the up-stream faces are protected—one with boards and one with riprapping. Freeboard, from 5 to 10 feet; width of spillways, from 4 to 20 feet. Contents on May 1 and November 1, 1912, from 1,350,000 to 696,690 cubic feet. Seven dams are reported good; one in bad condition; five suffered from "broken dykes," and in one case the spillway is reported "washed out."

The conditions of 1911 have not noticeably improved, but the topography and the character of the soil, which absorbs most of the stored water and returns it to the small stream beds, do not seem to encourage the owners of these reservoirs to the extent of better construction, nor affect them with the possible danger from serious dam breaks. Most of these little storage ponds have been constructed in the most primitive manner, and the banks in some cases have retained their original cross-section, although scarcely any repairs, or even ordinary maintenance, seem to have been effected.

Respectfully submitted,

[Signed] THEODORE ROSENBERG,
Irrigation Division Engineer, Division No. 5.



HALLIGAN DAM
North Poudre Irrigation Company. Maximum Height, 76 Feet. Length, 340 Feet.
Reservoir Capacity, 7,900 Acre-Feet.
G. N. Houston, Consulting Engineer

GRASS VALLEY DAM
(During Construction, August 15, 1910)
Antlers Orchard Development Company. Maximum Height, 70 Feet. Length, 680 Feet. Reservoir Capacity, 4,000 Acre-Feet.
A. G. Allan, Chief Engineer

CHAPTER VI.

ABSTRACTS OF REPORTS OF WATER COMMISSIONERS

The following tables show the quantity of water used by various ditches and reservoirs during the seasons of 1911 and 1912. They are abstracted from the annual reports of the water commissioners and cover all reports of ditches to which twenty-five cubic feet per second or more of water has been decreed, and all reservoirs concerning which the necessary information is obtainable.

The first series of tables shows for each ditch the first and last day on which water was used, the number of days water was carried, the average daily quantity in cubic feet per second, the number of acre-feet of water used, the number of acres irrigated, and the duty of water for each of the seasons 1911 and 1912. In some instances the figures given by the water commissioners' reports were obviously in error, and such have been omitted. In other cases a part of the information desired could not be obtained. However, the tables contain a sufficient volume of information, especially on the much disputed question of the duty of water, to repay careful study. The tremendous variation in the duty is due partly to real difference in economy in the use and distribution of water, and in some few cases to inaccuracy of the figures furnished by the water commissioners. By far the greater part of this information, however, is believed to be substantially correct.

The second series of tables shows for each reservoir reported its capacity, the ditches supplied from it, and the volume of water in the reservoir on May 1st and November 1st of each of the years 1911 and 1912. This information is much less complete than in the case of the ditches, because, particularly in the case of the smaller reservoirs, accurate capacity surveys have not been made, and the reservoir owners content themselves with more or less accurate guesses. In these tables, as in those of the first series, figures which were obviously erroneous have been omitted. There is a possibility of error in some of those given, but it is not believed that these errors are large.

DISTRICT 1. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Bijou	181.23	Apr. 5	Apr. 14	*to Nov. 1	Nov. 15	194	203	56	220	21,728	89,320	2,131	11,000	10.2	8.1
Corona Ranch	56	May 15	June 1	July 10	June 27	53	27	19	18	2,014	962	112	800	17.9	1.2
Shults	28	Apr. 27	....	July 10	....	44	......	6	......	528	....	262	800	2.2	......
Putnam	40	May 14	May 4	Oct. 27	Oct. 10	144	149	13	14	3,744	4,172	2,500	2,500	1.5	1.67
Weldon Valley	165	Mch. 10	May 5	*to Nov. 1	Nov. 9	193	183	67	67	25,862	22,522	6,070	6,500	4.3	3.46
Ft. Morgan Canal	323	Mch. 21	Apr. 8	*to Nov. 1	Nov. 15	33	160	175	149	17,856	47,680	4,357	12,000	4.1	3.97
Upper Platte and Beaver	234.17	Mch. 27	Apr. 5	*to Nov. 1	Nov. 15	197	190	45	74	17,730	28,120	11,300	11,500	1.6	2.44
Deuel & Snyder	45	Mch. 22	Apr. 18	Oct. 16	Oct. 16	156	157	8	14	2,456	4,396	1,100	2,000	2.2	2.19
Brown & Piatt	39	Apr. 19	Apr. 18	July 10	Aug. 4	83	85	7	8	1,162	1,360	500	500	2.3	2.73
Lower Platte and Beaver	322	Feb. 10	Apr. 4	*to Nov. 1	Oct. 8	201	185	15	59	6,030	21,830	3,950	13,400	1.5	1.63
Johnson and Edwards	63	Mch. 10	Apr. 12	Aug. 25	Aug. 26	98	103	14	17	2,828	3,502	1,875	2,280	1.5	1.54
Tetsel	37	Mch. 22	May 27	*to Nov. 1	Nov. 15	207	140	17	13	6,028	3,640	1,500	1,502	4.0	2.42
Beaver	44	....	Apr. 20	....	Oct. 5	......	185	......	5	....	1,850	....	670	......	2.76

DISTRICT 2. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Brantner	129	Apr. 6	May 1	*to Nov. 1	Oct. 31	215	184	34	29	14,620	10,672	4,870	4,525	3.0	2.36
Platteville	185	Apr. 1	May 3	*to Nov. 1	Oct. 31	226	182	42	35	18,984	12,740	3,575	4,840	5.3	2.64
Farmers' & Gardeners'	85	Apr. 1	May 1	*to Nov. 1	Oct. 31	232	177	8	10	3,512	3,540	220	340	15.9	1.04
Lupton Bottom	197	Apr. 10	May 4	Nov. 11	Oct. 31	202	180	35	21	13,370	7,560	2,228	2,033	6.0	3.73
Brighton	124	Apr. 3	May 1	Nov. 26	Oct. 31	226	195	22	19	9,944	7,410	2,370	2,615	4.2	2.84
Fulton	448.8	Apr. 1	May 1	Nov. 19	Oct. 31	211	192	85	88	35,870	33,792	10,805	10,765	3.3	3.14
Farmers' Independent	498	Apr. 1	May 5	Oct. 22	Oct. 10	202	136	60	82	24,240	22,204	5,950	9,125	4.1	2.44
Meadow Island No. 1	49	Apr. 8	May 28	Sept. 7	Sept. 14	103	104	16	15	3,296	3,120	1,455	1,545	2.3	2.02
Meadow Island No. 2	66	Apr. 8	May 28	Sept. 7	Sept. 14	113	85	19	10	4,294	1,700	640	757	6.7	2.25
Hewes & Cook	155	May 1	May 1	Oct. 9	Sept. 21	136	132	57	56	15,504	14,784	3,231	7,172	4.8	2.06
Hodgson	94	May 1	May 1	Sept. 30	Oct. 31	100	100	9	6	1,800	1,200	263	188	6.9	6.38
Lower Latham	360	Apr. 15	May 7	Oct. 9	Sept. 23	187	140	75	72	28,050	20,160	7,385	8,315	3.8	2.42
Section No. 3	127	Apr. 22	June 1	Oct. 9	Sept. 14	171	94	26	14	8,892	2,632	1,158	1,483	7.7	1.77
Highland	104	May 1	June 10	Oct. 9	Sept. 20	153	75	10	13	3,060	1,950	520	610	5.9	3.20
Evans' No. 2	409	June 4	May 24	Oct. 31	Oct. 31	48	147	174	156	16,704	45,864	4,915	9,730	3.4	4.71
Beeman	127	July 4	May 21	Oct. 31	Sept. 14	62	105	18	14	2,232	2,940	835	1,165	2.8	2.52
Bucker's	108	July 5	May 20	Oct. 23	Sept. 24	12	91	46	25	1,104	2,550	1,755	5,560	0.63	0.46
Union	187	Apr. 10	May 6	*to Nov. 1	Sept. 20	207	131	55	79	22,770	20,698	3,490	5,182	6.5	4.00
Burlington	350	June 20	May 1	*to Nov. 1	Oct. 31	115	173	22	159	5,060	55,014	11,518	11,530	0.4	4.77

* Still using.

DISTRICT 3. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Dry Creek	50.92	Apr. 15	Apr. 29	Sept. 30	Sept. 14	169	139	23	26	....	4,600	2,300	2,300	......	2.00
Pleasant Valley	138	Apr. 15	Apr. 28	Sept. 27	Sept. 14	166	140	50	57	....	11,400	7,000	7,000	......	1.63
Boyd & Freeman	99	May 10	June 1	Sept. 25	Sept. 12	129	104	7	10	....	1,400	700	700	......	2.00
Whitney	61	Apr. 21	May 24	Sept. 30	Sept. 13	159	113	24	30	....	4,500	2,500	2,500	......	1.80
B. H. Eaton	41	May 2	May 28	Sept. 30	Sept. 13	142	109	12	12	....	2,100	1,100	1,100	......	1.91
Larimer & Weld	720	Apr. 15	Apr. 29	Sept. 26	Sept. 14	165	139	114	350	....	94,500	52,500	52,500	......	1.80
J. G. Coy	31	Apr. 18	May 8	Sept. 30	Sept. 9	158	115	7	7	....	600	290	290	......	2.07
Box Elder	52.7	Apr. 22	May 1	Sept. 12	Sept. 13	149	136	18	18	....	3,750	2,000	2,000	......	1.87
Josh Ames	36	May 9	May 3	Sept. 17	Sept. 9	101	130	5	7	....	1,055	710	710	......	1.49
Cache la Poudre	82.5	Apr. 29	May 26	Aug. 26	Sept. 1	102	99	16	20	....	2,400	1,600	1,600	......	1.50
Ft. Collins Canal	130	Apr. 17	May 1	Sept. 30	Sept. 17	167	140	12	18	....	6,900	3,600	3,600	......	1.92
New Mercer	163	Apr. 30	Apr. 30	Aug. 30	Sept. 5	96	129	23	47	....	10,050	6,700	6,700	......	1.50
Canal No. 3	173	Apr. 5	May 1	Oct. 8	Sept. 12	156	130	51	55	....	9,000	4,000	4,000	......	2.25
Cache la Poudre Irri. Co.	585	Apr. 30	May 8	Sept. 7	Sept. 20	97	127	249	340	....	102,500	41,000	41,000	......	2.50
Burnham & Emerson	26	....	May 15	....	Aug. 15	......	92	......	4	....	600	330	330	......	1.82
Lake	158	May 9	May 3	July 9	Aug. 6	56	96	111	75	....	12,000	8,000	8,000	......	1.50
Larimer Co. Canal No. 2	175	May 1	May 6	Sept. 14	Sept. 16	134	134	46	80	....	10,800	1,200	7,200	......	1.50
Larimer Co.	463	Apr. 15	Apr. 30	Sept. 5	Sept. 14	144	138	......	300	....	78,750	45,000	45,000	......	1.75
Emerson Bros.	30	....	....	....	....	......	......	......	5	....	525	350	350	......	1.50
Ogilvy	57.6	....	....	....	....	......	......	......	......	....	7,250	4,000	4,000	......	1.81

DISTRICT 4. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Handy	192	Apr. 16	May 1	Nov. 2	Oct. 1	201	153	23	82.25	10,543	25,168	12,435	13,500	0.96	1.86
Home Supply	278	Apr. 4	Apr. 1	Aug. 31	Oct. 14	149	183	40	66.5	20,975	24,339	21,940	22,250	0.96	1.09
South Side	50	May 11	May 27	Sept. 5	Sept. 27	113	121	7.25	12.18	2,084	2,948	3,025	3,200	0.69	0.92
Louden	317	Apr. 1	Apr. 24	Oct. 7	Oct. 8	192	165	34	45.5	12,971	15,015	15,515	15,780	0.84	0.95
Geo. Rist	195	May 23	Apr. 8	Nov. 6	Aug. 12	112	99	25	18.5	5,553	3,662	4,895	5,380	1.14	0.68
Rist & Goss	65	May 15	June 1	Aug. 5	Aug. 23	83	84	3.5	4	96	672	450	435	0.21	1.54
Barnes	43	Mch. 23	Mch. 31	Nov. 14	Nov. 11	171	194	13	100	4,409	38,800	1,570	1,755	2.81	22.10
Loveland and Greeley	408	Mch. 23	May 24	Nov. 14	Sept. 29	174	106	40	174	18,396	36,888	19,370	19,215	0.95	1.92
Big Thompson No. 2	126	May 17	June 6	Oct. 5	Sept. 19	109	93	15	22	3,350	4,092	1,870	2,000	1.79	2.04
Farmers'	62	May 20	June 5	Aug. 29	Sept. 25	90	89	14	15.4	2,491	2,385	3,570	4,050	0.70	0.59
Hillsborough	153	Apr. 16	Mch. 31	Nov. 14	Sept. 25	212	154	35	55.7	15,044	17,156	9,175	9,385	1.64	1.83
Hill & Brush	61.8	Apr. 26	May 25	Oct. 6	Sept. 8	142	106	6	10.12	1,690	2,144	1,375	1,450	1.23	1.48
Big Thompson and Platte River	121	May 1	May 26	Oct. 6	Sept. 20	158	117	24	28	7,521	6,552	1,755	1,820	4.28	3.59
Culver and Mahoney	38	June 1	....	July 30	....	60	......	3.3	......	396	....	400	....	0.99	......
Supply Lateral	35.57	....	May 6	....	Sept. 14	......	123	......	9	....	2,214	....	865	......	......
Boulder and Larimer Co.	66.72	....	May 6	....	Sept. 14	......	105	......	63	....	13,230	....	2,405	......	......
Miner and Lougan	40.8	....	June 1	....	Sept. 16	......	108	......	7	....	1,620	....	860	......	......

DISTRICT 5. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used 1911	First Day Water Used 1912	Last Day Water Used 1911	Last Day Water Used 1912	Number Days 1911	Number Days 1912	Average Daily 1911	Average Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres Irrigated 1911	Acres Irrigated 1912	Duty 1911	Duty 1912
South Ledge	31	Apr. 25	May 8	Oct. 6	July 26	68	91	7.2	10	916	1,801	1,075	1,105	0.85	1.63
Supply	92.2	Apr. 25	Feb. 23	Oct. 5	Oct. 9	88	158	40	42.6	8,152	13,335	8,900	9,900	0.92	1.35
Highland	229	Mch. 29	Mch. 5	Oct. 3	Sept. 29	211	193	82.5	156	34,804	56,356	29,790	33,400	1.17	1.68
Rough and Ready	83.3	Apr. 1	Apr. 8	Oct. 16	Oct. 8	199	160	36.5	31.4	14,332	10,048	6,550	7,950	2.19	1.26
St. Vrain and Palmerton	164.31	Apr. 28	Apr. 8	Oct. 12	Sept. 30	166	148	17	13.5	5,644	38,184	....	1 100	......	34.70
Longmont Supply	53.4	Apr. 17	May 28	Oct. 31	Sept. 24	197	106	12.5	16	4,900	3,360	....	3,247	......	1.03
Oligarchy	239.31	May 8	Apr. 8	Oct. 1	Sept. 23	147	157	27	42.5	8,340	13,235	3,513	4,087	2.37	3.24
Denio and Taylor	41.8	Apr. 23	May 27	Oct. 1	Sept. 23	142	85	3.5	4	988	476	800	1,015	1.23	0.47
Hayseed	41.54	Apr. 15	June 10	Sept. 11	Aug. 10	128	62	2.75	2	694	124	200	210	3.47	0.59
Last Chance	96.94	May 9	June 15	Oct. 17	Sept. 10	196	88	20	23	7,920	3,960	1,159	1,886	6.85	2.10
James	27.11	May 6	May 8	Oct. 27	Sept. 23	154	100	4.5	8.25	1,438	1,080	3,000	3,365	0.48	0.32
Zweck and Turner	82.61	May 9	May 28	Oct. 10	Sept. 23	154	110	4.9	3.8	1,528	132	580	655	0.26	0.20
Pella	42.64	May 13	June 1	Oct. 13	Sept. 23	155	110	9.88	8.5	3,084	187	....	775	....	0.24
Ni Wot	35.96	May 13	June 1	Sept. 30	Sept. 23	127	111	5.75	3.5	1,468	666	745	730	1.97	0.92
South Flat	71.43	May 13	June 6	Sept. 30	Sept. 23	130	110	8.50	7.8	2,222	1,650	815	835	2.73	1.98
Chapman & McCaslin	98.13	May 17	June 1	Sept. 30	Sept. 12	124	104	2.58	1.8	652	312	430	435	1.52	0.72
Goss Private	29.51	May 17	June 1	Oct. 5	Sept. 7	81	99	2	1.0	338	198	310	295	1.09	0.67
Left Hand	726	....	May 8	....	Sept. 8	......	124	......	43	....	10,540	....	15,500	......	0.68

DISTRICT 6. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Community	83.3	....	Apr. 15	....	July 21	.....	76	.....	50	....	9,500	....	11,370	.....	0.92
So. Boulder and Coal Creek	65.93	May 2	Apr. 17	Sept. 3	Oct. 11	24	69	24.4	23.5	1,171.2	3,274	1,375	3,000	0.85	1.09
Davidson	221.35	Apr. 22	May 7	Oct. 4	Sept. 26	43	91	39.1	37.8	3,762.6	6,896	4,175	7,420	0.90	0.93
Goodhue and Rock Creek	96.23	Apr. 29	May 4	Oct. 2	Sept. 10	19	94	32.9	41.5	1,250.2	7,796	2,655	7,325	0.47	1.06
Dry Creek No. 2	69	Apr. 27	May 8	Sept. 17	Sept. 12	95	117	6.5	6.7	1,216	1,562	1,340	1,325	0.91	1.18
Marshallville	47.76	Apr. 29	May 16	Sept. 8	Oct. 17	84	105	13.5	10.7	1,144	2,256	1,495	1,540	0.77	1.46
South Boulder Canon	218.37	May 8	Apr. 26	Sept. 7	Sept. 24	60	120	32.2	16.2	3,864	3,896	2,955	3,210	1.31	1.21
Howard	36	Apr. 27	Apr. 29	Oct. 27	Sept. 7	137	141	6	7.9	1,644	2,240	1,200	1,240	1.37	1.80
East Boulder	228.58	Apr. 27	May 1	Oct. 27	Sept. 11	129	98	6.8	5.8	1,954.4	1,156	995	910	1.97	1.27
Enterprise	128.6	May 1	Apr. 24	Sept. 30	Aug. 19	85	84	8.8	7.9	1,456	1,332	1,315	1,340	1.11	0.99
Cottonwood No. 2	33.7	May 13	Apr. 28	Sept. 27	Sept. 2	90	82	9.6	8.3	1,728	1,374	730	745	2.36	1.85
Leyner and Cottonwood No. 1	170.38	May 15	June 5	Sept. 29	Sept. 24	104	103	25.4	18.4	5,283.2	3,802	3,355	8,385	1.58	0.45
Schearer	40	June 1	....	Oct. 1	....	90	.....	1	.....	180	....	200	....	0.90	.....
Silver Lake	45	May 10	May 9	Sept. 12	Aug. 19	101	97	7.9	9.9	1,595.8	1,922	1,350	1,225	1.18	1.57
Anderson	25	May 4	May 9	Sept. 24	Sept. 12	143	112	5.3	8.4	3,031.6	1,898	830	860	3.65	2.21
Farmers'	73.29	May 4	May 9	Sept. 12	Sept. 19	108	118	38.4	26.1	8,294.4	6,182	3,535	3,580	2.34	1.72
Boulder and White Rock	656.3	Apr. 7	May 24	Aug. 10	Sept. 17	43	77	35	49.2	3,010	7,588	7,025	7,450	0.43	1.02
Smith and Goss	44.3	May 5	May 9	Sept. 11	Sept. 9	130	93	2.9	2	754	378	220	225	3.42	1.68
Boulder and Left Hand	246.6	May 4	May 29	Sept. 7	Sept. 17	113	87	8.9	9.2	2,018.1	1,612	4,185	4,140	0.48	0.39
North Boulder Farmers'	190.78	May 9	May 9	Sept. 7	Sept. 17	111	107	22.4	13.5	4,792.8	2,894	3,340	3,395	1.43	0.86
Green	34.58	May 9	June 10	Sept. 11	Aug. 21	95	74	3.8	2.7	722	400	600	540	1.20	0.74
Butte Mill	110.4	May 10	June 10	Aug. 29	Aug. 19	78	51	9.4	6.5	1,466.4	672	1,045	1,080	1.40	0.62
Leggett or Charity	31.35	May 8	May 24	Aug. 28	Sept. 19	77	95	29.6	33.7	4,568.4	6,408	4,680	4,645	0.98	1.40
Lower Boulder	122	May 8	June 4	Sept. 25	Sept. 19	141	108	43.9	46.1	12,379.8	9,962	9,675	9,960	1.28	1.00
Boulder and Weld Co.	59.4	May 15	June 4	Aug. 14	Aug. 19	53	59	13.7	27.6	1,460	3,268	2,525	2,540	0.58	1.29
Smith and Emmons	47.16	May 17	June 4	Aug. 31	Aug. 17	54	55	7.3	7.3	794	804	727	733	1.09	1.10
Delehant	37.12	May 15	June 15	July 26	July 23	25	22	8.2	5	414	220	450	462	0.92	0.48
Highland South Side	152	May 15	June 7	Aug. 12	Sept. 9	55	73	20.9	22.8	2,300	3,338	1,265	1,330	1.82	2.51
Carr and Tyler	33.7	May 16	June 15	July 8	July 29	36	42	4.4	6.8	322	572	160	165	2.00	3.46

DISTRICT 7. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used 1911	First Day Water Used 1912	Last Day Water Used 1911	Last Day Water Used 1912	Number Days 1911	Number Days 1912	Average Daily Amount 1911	Average Daily Amount 1912	Acre-Feet 1911	Acre-Feet 1912	Acres Irrigated 1911	Acres Irrigated 1912	Duty 1911	Duty 1912
Golden Canal	720.66	Feb. 9	Feb. 1	Nov. 26	Nov. 2	273	207	54.3	106.5	29,510	46,201	28,000	39,150	1.05	1.18
Swadley	25	May 11	Apr. 29	Oct. 6	Oct. 16	134	122	7	6.35	1,876	1,549	630	700	2.98	2.21
Fisher	35	Apr. 15	Apr. 20	Oct. 8	Nov. 7	115	146	12.25	12	2,830	3,504	1,200	850	2.36	4.12
Clear Creek and Platte Riv.	70.06	Apr. 16	Apr. 18	Nov. 12	Nov. 11	191	196	15.6	22.5	5,970	8,820	2,600	2,550	2.29	3.46
Rocky Mountain	177 3	Apr. 25	May 5	Nov. 2	Nov. 16	139	126	50.9	50.35	14,130	12,696	7,800	7,800	1.82	1.62
Lee, Stewart and Eskins	33.19	Apr. 15	May 3	Nov. 24	Nov. 7	171	151	8.8	9.2	2,997	2,789	2,340	2,320	1.28	1.20
Golden City and Ralston Creek	110.9	Mch. 10	Jan. 14	Nov. 25	Nov. 25	162	204	43.5	59.4	14,598	24,250	12,750	12,100	1.14	2.00
Colorado Agricultural	62	Apr. 23	Apr. 29	Nov. 11	Nov. 16	161	187	16.75	22.6	5,364	8,470	2,150	2,430	2.50	3.48
Golden	26	Apr. 23	Mch. 5	Nov. 16	Oct. 22	120	114	17.5	18.3	4,600	4,186	3,500	3,600	1.31	1.16
Agricultural	150	Feb. 9	Jan. 25	Dec. 5	Nov. 21	64	151	52.45	83.4	6,720	21,900	10,000	13,500	0.67	1.62

DISTRICT 8. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Platte Water Co...........	85.95	Apr. 5	Apr. 10	Nov. 5	Oct. 23	215	104	29.5	33.11	12,785	12,184	1,775	1,150	7.20	10.60
Nevada..................	62.3	Apr. 4	Apr. 25	Nov. 1	Oct. 27	211	186	30.49	22.38	12,866	8,325	1,640	1,778	7.85	4.68
Last Chance..............	32	Apr. 12	Apr. 20	Nov. 1	Oct. 31	115	195	22.07	18.6	5,076	7,254	1,065	1,115	4.77	6.50
Platte Canon.............	56	Apr. 26	May 29	Nov. 1	Oct. 11	177	132	17.89	19.25	6,333	5,082	1,115	851	5.67	5.96
Northern Colo. Irri. Co.....	1,184	Mch. 12	Apr. 8	Nov. 11	Oct. 21	54	160	162.4	232.27	12,500	79,904	25,250	20,540	0.50	0.89
First Attempt............	32	Mch. 18	May 1	July 30	Oct. 15	32	45	2	1.5	128	135	90	70	1.42	1.93
Arapahoe..............	50	Apr. 1	May 15	Oct. 28	Oct. 1	......	......	25	15	5,000	1,350	4,500	2,100	1.11	0.64
Rough and Ready.........	68.27	....	....	....	....	......	......	......	......	....	....	....	....	......	......
Platte and Denver........	61.71	....	....	....	....	......	......	......	......	....	....	....	....	......	......

DISTRICT 9. DIVISION 1.

Simonton................	35.76	May 11	May 31	Oct. 25	Sept. 25	154	108	5.18	7.27	1,598	1,574	561	419.5	2.85	3.75
Warrior..................	52.52	Apr. 6	May 29	Oct. 25	Oct. 13	170	119	20.23	18.99	6,879	4,520	1,369	1,449	5.02	3.13
Pioneer Union............	55.67	Mch. 25	May 29	Oct. 25	Oct. 21	165	130	10.26	10.96	3,388	2,850	633	707	5.35	4.03
Ward....................	63	Apr. 4	Jan. 23	Oct. 7	Oct. 31	8	179	8.62	16.47	2,803	4,478	389	1,347	7.22	3.55
Arnett...................	57.1	Mch. 19	Jan. 23	Nov. 3	Oct. 31	98	272	21.39	53	5,794	27,404	1,269	2,800	4.56	9.80
Lewis and Strouse........	30.68	Mch. 14	May 9	July 31	Sept. 21	36	48	2.03	2.41	150	232	17	30	8.82	7.74

DISTRICT 10. DIVISION 2.

Widefield................	26.73	Apr. 20	Mch. 10	Sept. 20	*to Nov. 1	20	50	12	12	....	....	345	458	......	......
Chilcott..................	27	Mch. 1	Mch. 15	Oct. 20	*to Nov. 1	25	50	20	15	....	....	1,129	1,589	......	......
El Paso..................	59.5	....	....	....	....	......	......	......	......	....	....	....	....	......	......

DISTRICT 11. DIVISION 2.

Missouri Park............	40	May 15	May 10	Oct. 1	Nov. 1	110	150	30	30	6,600	9,000	1,436	1,390	4.60	6.46
Riverside & Allen Ext.....	26	May 15	May 20	Sept. 1	Sept. 20	85	90	4	5	680	900	167	167	4.07	5.38
Bowen...................	50.9	May 1	June 1	Oct. 1	Sept. 1	70	90	20	30	2,800	5,400	597.5	597.5	4.70	9.03
Sunnyside Park...........	29.17	May 15	May 10	Oct. 15	Sept. 10	150	100	4.72	15	1,451	3,000	313	313	4.64	9.60
Starr....................	52.15	June 1	June 1	Sept. 1	Oct. 1	90	150	20	25	3,600	7,500	....	....	......	......
Stevens and Leiter........	36	Jan. 1	Jan. 1	Dec. 31	Dec. 31	365	365	36	36	26,320	26,280	....	....	......	......
Salida Power Co...........	136.6	Jan. 1	....	Dec. 31	....	365	......	136.6	......	....	....	....	....	......	......
Buena Vista Smelting Co...	115	....	....	....	....	......	......	115	......	....	....	....	....	......	......

* Still using.

DISTRICT 12. DIVISION 2.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Park Center	27	Apr. 25	Apr. 5	Oct. 11	Oct. 12	181	187	14	12.34	4,068	4,618	1,195	1,195	3.41	3.86
			1911												
Beaver Water & Irri. Co.	58	Jan. 1	Nov. 1	Oct. 31	Oct. 31	293	296	17.1	14.7	9,975	8,700	4,337	4,840	2.30	1.80
Union	48	Apr. 24	Nov. 1	Nov. 1	Oct. 31	177	337	29	21.4	10,466	14,350	781	845	13.40	17.00
South Canon	40	Apr. 26	Nov. 16	Nov. 1	Oct. 9	146	218	19	20	5,548	8,720	610	1,360	9.10	6.40
Canon City Hyd. & Irr. Co.	96	Apr. 26	Nov. 1	Nov. 1	Oct. 31	171	293	66	50	22,572	29,300	2,500	2,680	9.02	11.35
Canon City and Oil Creek	33.6	Apr. 26	Nov. 1	Nov. 1	Oct. 31	186	257	23	18	8,556	9,276	1,260	1,410	6.80	6.57
DeWeese Dye	28.5	Apr. 26	Nov. 5	Oct. 29	Oct. 28	155	183	18.5	11.7	5,735	4,290	1,100	1,140	5.20	3.77
			1912												
Fremont Water Supply Co.	57	Apr. 4	May 4	Oct. 1	Sept. 30	107	154	2.9	33	618	660	166	160	5.30	4.12
Cedar Park	32														
			1911												
Arkansas Valley	70	Apr. 22	Nov. 1	Nov. 1	Oct. 31	180	289	70	70	25,200	40,460				
DISTRICT 14. DIVISION 2.															
		1912													
Arkansas Valley	70														
Oxford Farmers'	130	Mch. 1	Mch. 24	Oct. 15	Nov. 1	212	193	52.6	56.6	11,151	21,871	5,700	5,740	1.96	3.82
Bessemer	370	Jan. 1	Jan. 13	Oct. 14	Nov. 7	283	284	110.3	133.6	62,426	71,610	18,742	19,612	3.33	3.65
Collier	26	May 28	July 1	July 31	Aug. 24	60	18	14	17.5	1,690	630	1,560	1,666	1.08	0.38
Excelsior	60	May 28	June 23	Nov. 1	Aug. 26	78	90	42	40	6,770	7,200	2,530	3,130	2.68	2.30
Pueblo Water Works	46														
		1910	1911												
Rocky Ford Highline	468.5	Nov. 1	Nov. 1	Oct. 31	Oct. 31	365	365	132	102.7	92,110	75,000	28,000	28,000	3.29	2.68
		1911	1912												
Colorado Canal	756.28	Jan. 1	Jan. 1	Nov. 1	Oct. 26	50	120	240	241.8	49,374	8,528	52,500	52,850	9.40	1.61
DISTRICT 16. DIVISION 2.															
Montes	37.64	Mch. 15	Mch. 20	Sept. 6	Aug. 20	38	41	44	10	334	1,620	150	165	2.23	9.82
Huerfano Valley	42	May 4	Apr. 1	Oct. 6	July 5	52	50	35	35	3,640	3,500	2,350	2,740	1.55	1.28
DISTRICT 17. DIVISION 2.															
		1910	1911												
Rocky Ford	209	Nov. 1	Nov. 1	Oct. 31	Nov. 1	323	305	85.3	72	27,552	43,920	9,100		3.03	
Jones Consolidated	124.3	Nov. 1	Apr. 17	Oct. 31	Nov. 1	314	197	30.2	50.4	18,966	19,858	6,500		2.92	
Las Animas Town	38	Nov. 1	Apr. 24	Oct. 28	Nov. 1	286	180	28	28.6	16,016	10,296	2,500		6.40	
Ft. Lyon	933	Nov. 1	Nov. 1	Oct. 31	Nov. 1	356	337	274.8	290	195,656	195,460	65,000		3.01	
Catlin	345	Nov. 1	Nov. 1	Oct. 31	Nov. 1	302	331	144.8	116	85,459	76,792	19,500		4.38	
Lake (Holbrook)	600	Dec. 28	Nov. 7	Oct. 7	Aug. 31	77	113	147.7	247	31,308	55,822	20,000		1.57	
		1911													
Otero	457.92	May 6	Nov. 3	Oct. 29	Sept. 5	33	56	156	140	17,804	15,680	12,200		1.46	
			1912												
Timpas Creek	51.84	May 7	June 2	Aug. 16	Aug. 31	20	16	10	16.4	400	5,248	3,200		0.13	
Omer	120.4	June 17		Oct. 25		10	20	90	25	1,800	1,000	1,000		1.80	
DISTRICT 18. DIVISION 2.															
Salisbury South Side	34.65	June 23		Aug. 20				7.95							

DISTRICT 19, DIVISION 2.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Baca or North Side	53.54	......	May 7	Oct. 1	Oct. 15	......	158	......	......	......	......	3,415	8,000	......	......
Pulaski (Enl.)	159.85	......	May 3	Oct. 1	Oct. 15	......	162	......	......	......	......	5,500	10,000	......	......
Hoehne	30	......	May 28	......	Nov. 1	......	152	......	......	......	......	......	1,000	......	......

DISTRICT 20. DIVISION 3.

NAME OF DITCH	Amount	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Aldrich and Aldrich	26.4	Apr. 29	May 1	Aug. 6	Sept. 20	84	130	12	......	......	......	215	285	......	......
Billings	25.64	May 10	May 10	Oct. 28	Oct. 12	165	165	25	......	......	......	1,065	1,035	......	......
Blanca	59.68	May 5	May 1	Oct. 1	Sept. 30	136	128	25	......	......	......	3,360	1,120	......	......
Centennial	82.4	May 4	May 10	Oct. 5	Sept. 14	148	119	40	......	......	......	2,480	590	......	......
Costilla	103.3	May 1	May 1	Nov. 5	Sept. 30	181	148	75	......	......	......	14,100	16,000	......	......
Empire Canal	667.5	Apr. 15	Apr. 15	Sept. 10	Sept. 19	124	157	150	......	......	......	22,100	32,700	......	......
Excelsior	75.1	May 4	May 1	Oct. 10	Oct. 1	151	132	65	......	......	......	4,000	7,800	......	......
Farmers' Union	1133.6	Apr. 5	Apr. 25	Oct. 4	Nov. 15	164	178	95	......	......	......	35,699	37,374	......	......
Hickory Jackson	36	May 9	May 9	July 6	Aug. 1	95	90	14	......	......	......	2,000	2,000	......	......
Independent No. 2	30.4	May 1	May 1	Oct. 5	Oct. 16	158	156	25	......	......	......	560	550	......	......
Monte Vista Canal	340.32	Apr. 1	Apr. 9	Sept. 19	Oct. 31	171	205	95.5	......	......	......	11,743	20,804	......	......
Rio Grande & Piedra Valley	263.5	Mch. 28	Mch. 1	Nov. 22	Oct. 25	240	239	60	......	......	......	6,577	4,567	......	......
Rio Grande and Lariat	104.41	Apr. 13	Apr. 2	Oct. 5	Nov. 2	164	210	75	......	......	......	4,000	4,540	......	......
Rio Grande	26.4	May 24	May 10	July 14	July 15	47	54	20	......	......	......	1,600	1,600	......	......
Rio Grande Canal	1690.52	Mch. 14	Apr. 5	Oct. 17	Nov. 2	209	209	576	......	......	......	84,305	85,506	......	......
Silva	26.2	Mch. 20	May 20	Oct. 5	Oct. 25	194	210	20	......	......	......	668	730	......	......
San Luis Valley Canal	450.98	Mch. 1	Mch. 10	Sept. 10	Nov. 15	190	210	92.5	......	......	......	5,940	10,630	......	......
Higgins No. 1	51.2	Apr. 1	May 1	July 20	Aug. 30	42	64	9.8	......	......	......	545	560	......	......
Rock Creek Overflow	25.6	Apr. 19	May 10	Aug. 6	Aug. 6	69	68	12	......	......	......	500	200	......	......
Strong Overflow	104.17	Apr. 20	Apr. 1	Aug. 6	Aug. 12	48	68	10	......	......	......	400	500	......	......
Prairie	253.63	......	Apr. 4	......	Sept. 6	......	144	......	......	......	......	......	8,522	......	......
South Farm Meadow	38.4	......	May 2	......	Aug. 26	......	90	......	......	......	......	......	460	......	......

DISTRICT 21. DIVISION 3.

NAME OF DITCH	Amount	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Norland	48	May 23	May 1	Aug. 1	Aug. 1	50	50	45	45	......	......	1,200	705	......	......
Flintham	25	May 23	May 1	Aug. 1	Aug. 1	45	45	20	20	......	......	1,000	600	......	......
Miller	66	May 23	May 1	July 25	July 25	40	40	40	40	......	......	2,500	1,210	......	......
Overflow No. 1	112	May 23	May 1	Oct. 1	Oct. 1	90	90	112	112	......	......	5,000	5,000	......	......
Plano Vista	30	May 23	May 1	Aug. 15	Aug. 15	60	60	20	20	......	......	1,720	1,650	......	......
Davies-Chapman	51	May 23	May 1	Sept. 1	Sept. 10	65	65	25	25	......	......	1,200	1,200	......	......
Scandinavian	43	May 23	May 1	Sept. 1	Sept. 1	65	65	30	10	......	......	1,000	1,000	......	......
Alamosa Creek Canal	50	May 23	May 1	Sept. 1	Sept. 1	60	60	40	40	......	......	4,220	4,220	......	......
Coddington	30	May 23	June 1	Aug. 1	Aug. 1	70	60	30	30	......	......	960	960	......	......
Ribera	28	Apr. 1	Apr. 1	Sept. 1	Sept. 1	45	45	15	15	......	......	400	360	......	......
La Joya	27	May 1	Apr. 1	Aug. 8	Aug. 1	45	60	20	20	......	......	600	585	......	......
Union	40	May 23	May 1	Sept. 1	Sept. 1	80	80	35	35	......	......	2,400	3,500	......	......
North Alamosa	49	May 23	May 1	Aug. 1	Aug. 1	70	70	40	40	......	......	640	......	......	......
Cottonwood	35.8	May 23	May 1	Aug. 1	Aug. 1	60	60	35.8	30	......	......	1,000	1,000	......	......
Overflow No. 4	40	May 23	May 23	Aug. 1	Aug. 1	50	55	15	15	......	......	500	500	......	......
Lower La Jara	44.8	May 23	May 1	July 30	July 30	40	40	44.8	44.8	......	......	2,000	1,700	......	......
Capulin	31	May 23	May 10	Oct. 1	Oct. 15	90	90	30	30	......	......	750	750	......	......
Head Overflow	49	May 23	Aug. 10	Oct. 1	Oct. 1	70	70	40	40	......	......	2,000	2,000	......	......
Alamosa Spring Creek	62	May 23	May 1	Aug. 1	Aug. 1	60	60	29	29	......	......	......	2,000	......	......
Aroya	53	......	May 1	......	Aug. 1	......	70	......	5	......	......	......	1,300	......	......

DISTRICT 22. DIVISION 3.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
Guadalupe	69.82	Apr. 1	Apr. 25	Oct. 1	Sept. 30	183	157					2,560	2,500		
Heads Mill & Irr.	117.44	Apr. 1	Apr. 25	Sept. 10	Sept. 15	163	142					80	80		
El Cado	25.18	Apr. 1	May 1	Sept. 15	Sept. 20	168	142					900	900		
Llano	31.84	Apr. 1	May 1	Sept. 1	Sept. 20	153	142					900	900		
Servieta	31.77	Apr. 1	May 1	Sept. 22	Sept. 23	175	145					3,000	3,000		
Seledonia Valdes	31.77	Apr. 1	May 1	Sept. 1	Aug. 24	153	116					640	800		
San Jose	40.28	Apr. 1	May 1	Sept. 1	Aug. 24	153	116					1,600	1,400		
Santiago	55.59	Apr. 1	May 1	Sept. 10	Aug. 7	163	99					480	480		
Trujillo	29.8	Apr. 1	May 1	Aug. 31	Aug. 5	153	97					300	300		
Canon	42.89	Apr. 1	May 1	Sept. 10	Aug. 7	156	109					1,700	1,700		
Del Rio	31.44	Apr. 1	May 1	Sept. 14	Aug. 7	148	109					640	1,280		
Fuerticitos	31.47	Apr. 1	May 1	Sept. 15	Aug. 1	147	93					400	510		
Mesitas	38.99	Apr. 1	May 1	Sept. 29	Aug. 7	164	109					450	2,000		
San Juan and San Rafael	47.76	Apr. 1	May 1	Sept. 29	Aug. 7	164	109					450	1,280		
Los Sauces	88.43	Apr. 1	May 1	Sept. 20	Sept. 1	173	123					1,600	1,600		
Lobato	27.58	Apr. 1	May 1		July 20		81					80	80		
Jose Bonifacio Romero	56.97	Apr. 1	May 1	Sept. 10	July 18	144	79					1,000	1,000		
Sanches	27.26	Apr. 1	May 1	Sept. 29	July 18	163	79					720	720		
Manassa	73.6	Apr. 1	May 1	Sept. 16	July 20	166	81					2,000	2,000		
J. M. Espinosa	26	Apr. 1	May 1	Aug. 8	July 11	130	77					60	61		
Ephraim	47	Apr. 1	May 1	Sept. 20	July 10	173	71					4,000	4,000		
Richfield	56.24	Apr. 1	May 1	Sept. 13	July 10	132	71					3,000	3,000		
Los Ojos	44.2	Apr. 1	May 1	Aug. 8	July 10	130	71					1,400	1,400		
Angustura	42.72	Apr. 1	May 1	Aug. 8	July 11	133	72					320	320		
North Eastern	34.71	Apr. 1	May 1	Aug. 7	July 11	132	72						12,000		
Cottonwood	28.5	Apr. 1	May 1	Sept. 1	July 25	143	86					40	240		
Manassa Westfield	30	Apr. 1	May 1	Oct. 1	July 12	164	73					13,440	10,000		
Sanford	107.5	Apr. 1	May 1	Sept. 10	July 12	143	73					4,000	2,500		
Alamo	96	Apr. 1	May 1	Aug. 6	July 25	128	86					2,080	2,080		
Antonito	250	Apr. 1	May 1	Aug. 6	July 11	128	57					1,000	2,450		
Mogote	342.4	Apr. 1	May 1		July 11		72						12,000		
Martines	26		May 1		July 5		66						80		
Taos Valley No. 2	500	Apr. 1	Apr. 10	July 15	July 5	106	86					3,000	3,000		

DISTRICT 23. DIVISION 1.

Rayner & Edmonson No. 1	25	May 15													
Berry	39.4	May 15													
Mill	43.46	May 1													
Donovan	45	May 1													
Petrie	27	May 1													
Slater	27														
Guiraud	49.97	May 10													
Canon	57.54	May 15													
Sigafus	25	May 15													
Kester Sweet	25.39	May 25													
Weed	40.8	May 10													
Sigafus, 1st Enl	25	May 15													

DISTRICT 23. DIVISION 1—Concluded.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used 1911	First Day Water Used 1912	Last Day Water Used 1911	Last Day Water Used 1912	Number Days Water Carried from Natural Stream 1911	Number Days Water Carried from Natural Stream 1912	Average Daily Amount of Water During Season 1911	Average Daily Amount of Water During Season 1912	Number of Acre-Feet Used During Season 1911	Number of Acre-Feet Used During Season 1912	Number of Acres Irrigated 1911	Number of Acres Irrigated 1912	Duty in Acre-Feet Per Acre 1911	Duty in Acre-Feet Per Acre 1912
Parmelee & Shoemaker	35.54	May 10													
Sadler	49.5	May 20													
Prince, 1st Enl	45.6	May 15													
Parmelee & ShoemakerNo.3	38.48	May 18													
Haver No. 2	39.98	May 20													
Foster	42.58	May 15													
Hot Springs	28	May 1													
Parmelee&Shoemaker No.4	44.34	May 2													
Central	37	May 15													
Frank's	37.5	May 25													
Burlingame	27	June 1													
Hotel	29	May 10													
Thompson and Radcliffe	27	May 20													
Rogers North Ditch	84	May 20													
Elisha Alden	56.49	May 15													
Rayner & Edmonson No. 2	.25	May 20													
Rogers	45.74	May 20													
Pierce	55	May 20													
Thompson	35	May 20													
Anderson	35	May 15													
W. F. Miller No. 1	26.2	May 20													
Western	66	May 1													
Bonnell	27	May 20													
Rogers South Ditch	84	Apr. 20													
Devine Hill	40	Apr. 25													
Park	65	May 20													

DISTRICT 24. DIVISION 3.

Sanchez Canal	606	June 22		Oct. 31		132		52.1		13,754					
Cordillera	35											2,700			
San Luis Mill	27														
Eastdale Culebra No. 1	25	Jan. 1		Oct. 31		307		32.06		19,685					
Culebra Eastdale	722														

DISTRICT 25. DIVISION 3.

Baca Grant	125.97		Apr. 1		Oct. 1		40		108		8,640		4,210		2.05
Wale and Shellanbarger	53.1		Apr. 1		Oct. 1		40		6		480		1,618		0.30

DISTRICT 26. DIVISION 3.

Travis	25	July 2	May 6	Aug. 21	July 11	20	66	21.7	25			1,250	1,250		
Company	105.46	Apr. 1	May 3	Oct. 16	June 24	135	52	32.37	79			3,545	3,540		

DISTRICT 30. DIVISION 3.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used 1911	First Day Water Used 1912	Last Day Water Used 1911	Last Day Water Used 1912	Number Days Water Carried from Natural Stream 1911	Number Days Water Carried from Natural Stream 1912	Average Daily Amount of Water During Season 1911	Average Daily Amount of Water During Season 1912	Number of Acre-Feet Used During Season 1911	Number of Acre-Feet Used During Season 1912	Number of Acres Irrigated 1911	Number of Acres Irrigated 1912	Duty in Acre-Feet Per Acre 1911	Duty in Acre-Feet Per Acre 1912
Animas Valley	40		May 1		Oct. 31		185		40				1,000		
Animas Consolidated	90		May 1		Oct. 31		185		90				2,342		
Florida Farmers' Co-op.	75		May 1		Oct. 31		185		45				4,500		
Wood and Morgan Pump Plant	70		Jan. 1		Dec. 31										

DISTRICT 41. DIVISION 4.

NAME OF DITCH	Amount of Appropriation	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Chipeta Montrose	34	Mch. 10	Mch. 1	*to Nov. 1	Nov. 1		240					775	1,350		
Montrose City	26			*to Nov. 1	*to Nov. 1							100	100		
Delta Chief	42	Mch. 1	Mch. 10	*to Nov. 1	Nov. 1		290					1,250	1,150		
Logan	25		Mch. 1		Nov. 11		240					800	800		
Reservation	26		Mch. 1	*to Nov. 1	Nov. 10		240					900	900		
Uncompahgre and Cedar Valley	85	Mch. 10		*to Nov. 1								1,400			
Colorow	25	Mch. 10	Mch. 1	*to Nov. 1	Nov. 10		240					600	850		
Midland	28		Mch. 1		Nov. 1		240					700	600		
Eagle	33.85	Mch. 1	Mch. 10	*to Nov. 1	Nov. 10		240		18			1,850	2,100		
Loutsenhiser	81.6	Mch. 1	Mch. 1	Nov. 15	Nov. 1	300	240		85			2,900	4,000		
Delta	30		Mch. 11	Nov. 15	Nov. 11		250		10			1,000	1,250		
Ironstone	151	Mch. 1	Mch. 1	Nov. 15	Nov. 11		215		75			6,950	5,800		
Montrose and Delta	481	Mch. 15	Mch. 15	Oct. 15	Nov. 1	210	225		350			16,550	14,500		
Garnett	93	Mch. 1	Mch. 1	*to Nov. 1	Nov. 10		225		45			1,500	1,500		
Home Run	47		Mch. 1	*to Nov. 1	Nov. 10		225		28			2,000	1,500		
Selig	85	Mch. 1	Mch. 1	*to Nov. 1	Nov. 10		225		25			950	1,750		
North Mesa	45	Mch. 1	Mch. 1	*to Nov. 1	Nov. 11		206		2			300	50		

DISTRICT 44. DIVISION 5.

NAME OF DITCH	Amount of Appropriation	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Lily Park No. 1	36.67	May		July 20		70		20							
Cross Mountain	42	May		Aug.		75		20				605			

DISTRICT 45. DIVISION 5.

NAME OF DITCH	Amount of Appropriation	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Highline Canal	105											3,024	3,024		
Porter	42.6											2,046	2,143		
L. & C.	40											250	248		

DISTRICT 35. DIVISION 3.

NAME OF DITCH	Amount of Appropriation	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
Trujillo	30	June 5		July 15		40		30				2,000			

DISTRICT 38. DIVISION 5.

NAME OF DITCH	Amount of Appropriation	First Day 1911	First Day 1912	Last Day 1911	Last Day 1912	Days 1911	Days 1912	Avg. Daily 1911	Avg. Daily 1912	Acre-Feet 1911	Acre-Feet 1912	Acres 1911	Acres 1912	Duty 1911	Duty 1912
East Mesa	31.8								12				410		
Glenwood	30												621		

* Still using.

DISTRICT 39. DIVISION 5.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
A. O. D.	100	Apr. 1	May 1	Nov. 1	Oct. 15	186	168	.6	22.3	6,907	......	8,220	3,481	0.84	......
Grand Tunnel	26.5	May 1	May 1	Oct. 1	Oct. 15	150	168	10.9	11.8	......	......	1,249	1,150	......	......
Cactus Valley	50	May 1	May 1	Oct. 1	Oct. 15	150	168	......	......	......	......	1,622	917	......	......
Willcox Canal	300	May 1	May 1	Oct. 1	Oct. 15	150	168	......	......	......	......	6,508	......	......	......
Rifle Creek Canon	33.4	......	May 1	......	Oct. 15	......	168	......	20	......	......	......	1,076	......	......

DISTRICT 46. DIVISION 1.

Little Grizzly	25	May 1	May 1	July 1	July 15	60	75	15	18	1,800	2,700	550	550	3.27	4.91
Big Grizzly	30	May 1	May 20	July 17	July 25	77	65	18	22	2,772	2,860	800	1,280	3.46	2.24
Little Nellie	87.5	May 1	May 15	July 15	July 15	75	60	87	68	13,050	8,160	4,000	4,000	3.26	2.04
Chapman	27	May 10	May 25	July 13	July 30	62	65	27	24	3,402	3,120	800	800	4.26	3.90
Eureka	70	May 21	May 18	July 22	July 20	91	62	35	50	6,370	6,200	2,395	2,395	2.66	2.59
Mallon	37.5	May 1	May 18	July 10	July 20	70	62	37	32	5,180	3,968	2,500	1,200	2.07	3.31
Wolfer	146	May 1	May 20	July 20	July 22	70	62	85	125	11,900	15,500	7,300	7,300	1.63	2.16
Staples No. 1	35	May 10	May 12	July 15	July 20	65	68	35	35	4,550	4,760	2,120	1,820	2.14	2.61
Mitchell	31.75	May 5	May 15	July 20	July 15	75	60	21	26	3,150	3,120	700	700	4.50	4.45
Mutual	100	May 1	May 30	July 25	July 20	85	50	55	75	9,350	7,500	4,300	4,300	2.17	1.74
Independent	33.75	May 5	May 12	July 20	July 20	75	68	33	28	4,950	3,808	1,660	1,500	2.98	2.53
Roaring	38.25	May 15	May 8	July 15	July 20	60	72	24	24	2,880	3,456	1,000	1,000	2.88	3.46
Pleasant Valley	36	May 1	May 22	July 20	July 20	80	58	36	36	5,760	4,176	2,500	2,500	2.30	1.67
Staples No. 2	104.4	May 14	June 1	July 20	July 20	66	50	25	27	3,300	2,700	5,620	5,620	0.59	0.48
Darby	69.5	May 10	May 10	July 20	July 20	70	70	60	65	8,400	9,100	3,200	3,200	2.62	2.84
Hanson	93.24	May 1	May 5	July 20	July 20	80	75	20	50	3,200	7,500	7,000	7,000	0.46	1.07
Mallon	80	May 1	May 14	July 15	July 18	75	64	70	45	10,500	5,760	3,200	3,200	3.28	1.80

DISTRICT 47. DIVISION 1.

Old S. C.	31	May 1	May 1	July 15	July 15	76	76	......	......	......	......	1,000	......	......	......
Lost Treasure	42.41	May 1	May 1	July 15	July 15	76	76	......	......	......	......	1,120	......	......	......
Overland	29	May 1	May 10	July 15	July 10	76	62	......	......	......	......	1,000	......	......	......
Curtin	26.66	May 1	May 1	July 10	July 10	71	71	......	......	......	......	900	......	......	......
Bostwick Enl. and Ext.	71.5	May 1	May 1	July 10	July 11	71	71	......	......	......	......	2,100	......	......	......
Oklahoma	51	......	May 1	......	July 15	......	76	......	......	......	......	......	......	......	......

DISTRICT 48. DIVISION 1.

Sand Creek D. System	288	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Yelton	30.14	May 15	May 21	July 20	July 20	66	60	......	......	......	......	135	......	......	......
Laramie River	400	......	May 26	......	Oct. 16	......	144	......	65.27	......	......	......	......	......	......
Lone Tree	25	May 15	May 29	July 20	July 20	66	53	......	......	......	......	......	......	......	......

DISTRICT 60. DIVISION 4.

Gurley	62.5	May 10	......	Aug. 30	......	112	......	50	......	11,200	......	4,500	......	2.49	......
Colony	60	Apr. 29	......	Aug. 25	......	118	......	45	......	10,620	......	4,600	......	2.31	......

DISTRICT 62. DIVISION 4.

Cimarron Canal	60	......	......	......	......	......	......	......	......	13,836	13,836	5,369	5,369	2.57	2.57

DISTRICT 64. DIVISION 1.

NAME OF DITCH	Amount of Appropriation in Cu. Ft. Per Sec.	First Day Water Used		Last Day Water Used		Number Days Water Carried from Natural Stream		Average Daily Amount of Water During Season		Number of Acre-Feet Used During Season		Number of Acres Irrigated		Duty in Acre-Feet Per Acre	
		1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912
South Platte	100	Mch. 26	May 25	*to Nov. 1	Sept. 14	220	90	30	37	13,200	6,660	3,400	4,000	3.88	1.66
Sterling Irrigation	113	Mch. 29	May 26	Oct. 5	Sept. 14	200	78	60	60	24,000	9,560	7,200	5,515	3.34	1.73
Pawnee	197	Mch. 15	Apr. 10	*to Nov. 1	Sept. 14	210	122	64	75.5	26,800	9,211	8,000	15,015	3.35	0.61
Schneider	47	Mch. 22	June 1	Oct. 5	Sept. 13	225	76	31	30.5	13,750	4,648	3,400	2,510	4.05	1.85
Low Line	39	Mch. 31	May 22	Nov. 2	Sept. 23	197	67	16	26.5	8,112	3,550	2,550	2,474	3.18	1.44
Iliff and Platte Valley	150	Apr. 7	May 1	Nov. 23	Sept. 15	187	107	42	66	15,228	7,062	4,500	8,800	3.39	0.80
Sterling No. 2	50	Mch. 17	June 15	Nov. 2	Sept. 8	35	43	18	31	1,260	2,666	600	2,253	2.10	1.18
Springdale	62	Mch. 10	Apr. 30	*to Nov. 1	Sept. 15	64	74	30	30.5	3,840	4,514	2,000	2,200	1.92	2.05
South Reservation	25	Mch. 15	May 28	*to Nov. 1	Sept. 1	100	42	15	15	3,000	1,260	1,000	1,300	3.00	0.97
Bravo	40	Mch. 15	May 12	*to Nov. 1	Sept. 3	50	53	20	26	2,000	2,756	950	1,790	2.11	1.54
Powell and Dillon	45	Mch. 17	May 13	*to Nov. 1	Aug. 30	124	61	9	35	2,224	4,270	745	1,875	2.99	2.28
Davis Bros	125	Mch. 15	June 1	*to Nov. 1	Sept. 13	31	76	16	20	982	3,040	440	2,280	2.23	1.35
Powell	40	Apr. 2	May 23	Sept. 28	Aug. 30	110	61	18	31	2,540	3,782	1,200	2,200	2.12	1.72
Harmony No. 1	252	Mch. 17	May 23	Sept. 20	July 7	40	40	15	47	1,500	3,760	500	2,415	3.00	1.56
Chambers	30	Mch. 10	May 30	*to Nov. 1	Aug. 10	35	46	15	22	1,050	2,024	300	1,240	3.50	1.63
Lone Tree	82														
Harmony No. 2	50	Mch. 12	May 19	Oct. 5	Aug. 17	15	42	10	46	300	3,864	175	1,435	1.71	2.69
Peterson	514	Mch. 10	May 1	*to Nov. 1	Sept. 15	100	83	30	65	6,000	12,806	2,100	10,500	2.86	1.22
Red-Line Supply	52	Mch. 20	May 9	*to Nov. 1	Aug. 16	30	45	15	26	900	2,040	500	1,100	1.80	1.85
Settlers	377	Mch. 15	May 24	Sept. 10	Aug. 24	100	61	10	30	2,000	3,660	950	7,500	2.10	0.49
Tamarack	134														
Highline	450	May 1								2,870		800	8,000	3.58	

DISTRICT 67. DIVISION 2.

		1910	1911												
Colorado and Kansas	97.31	Nov. 16	Nov. 19	Oct. 31	Nov. 15	193	197	27	33.4	10,422	13,010	3,445	3,734	3.02	3.50
Amity	283.5	Nov. 20	Nov. 16	Oct. 31	Nov. 15	208	211	181	228	37,648	96,496	30,961	31,870	1.22	3.04
Lamar	384.3	Nov. 16	Nov. 16	Oct. 31	Nov. 15	281	216	50	71	28,100	30,870	7,500	7,856	3.75	3.93
Manvel	54					3		25		150					
			1912												
X-Y	69	Nov. 16	May 26	Oct. 31	Sept. 15	170	71	22	28	7,480	4,040	3,915	3,273	1.91	1.23
		1911													
Graham	61	May 30	Apr. 10	Oct. 31	Nov. 15	39	158	23	16	1,794	5,230	1,500	1,700	1.20	3.08
		1910													
Buffalo	67.5	Nov. 16	Apr. 30	Oct. 31	Nov. 15	213	144	14	18.6	5,964	5,032	879	1,440	6.80	3.49

DISTRICT 68. DIVISION 4.

		1911													
Ridgway	25	June 25		Aug. 15		50						226			
Alkali	32	May 20		Nov. 1		160						1,127.5			

*Still using.

DISTRICT 1. DIVISION 1.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Jackson Lake	South Platte	1,543,991,407	Ft. Morgan Canal, Johnson & Edwards, Upper Platte and Beaver, Lower Platte and Beaver, North Sterling, Deuel & Snyder	916,657,711	0	1,286,175,715	0
Riverside	South Platte	2,860,000,000	Riverside Irr. Outlet Ditch to South Platte and then to such ditches as desired	544,462,567	0	830,146,970	749,432,460
Empire	South Platte	1,642,629,890	Bijou	99,027,592	0	189,827,237	425,000,000
Moore Res. Nos. 1, 2, 3	Deer Trail or MuddyCreek	46,000,000	Moore	6,000,000	0	0	5,000,000
Ft.Morgan L. & R.Co. No. 2	South Platte	435,600,000				0	0
Point of Rocks	South Platte	3,920,400,000				0	13,068,000

DISTRICT 2. DIVISION 1.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	1911 May 1	1911 Nov. 1	1912 May 1	1912 Nov. 1
Barr Lake (Oasis)	South Platte	495,000,000	E. & W. Hudson Lat.	495,000,000	0	461,736,000	871,200,000
Meek	South Platte	38,347,200	Laterals	38,347,200	0		
Clark	South Platte	15,794,480	Laterals	15,794,480	0		
East Line	South Platte	10,960,400	Laterals	10,960,400	0		
Henry Lake	South Platte	22,549,982	Laterals	22,549,982	0		
Bowles No. 1	South Platte	20,947,360	Laterals	20,947,360	0		
Bowles No. 2	South Platte	27,965,520	Laterals	27,965,520	0		
Curtis	South Platte	7,560,000	Laterals	7,560,000	0		
Higgins	South Platte	4,900,500	Laterals	4,900,500	0	4,900,500	0
Lutz	South Platte	2,380,200	Laterals	2,380,200	0	2,380,200	0
Magers	South Platte	2,321,021	Laterals	2,321,021	0	2,321,021	0
Calhoun	South Platte	2,722,500	Laterals	2,722,500	0		
Little Western	South Platte	5,500,000	Laterals	5,500,000	0	5,500,000	0
H. A. Smith	South Platte	4,530,240	Laterals	4,530,240	0	4,530,240	0
Rutherford	South Platte	1,787,500	Laterals	1,787,500	0	1,787,500	0
Skeel No. 1	South Platte	6,975,000	Laterals	6,975,000	0	6,975,000	0
Skeel No. 2	South Platte	2,327,500	Laterals	2,327,500	0	3,180,155	0
G. Smith	South Platte	3,018,255	Laterals	3,018,255	0		
Z. J. Fort	South Platte	7,168,200	Laterals	7,168,200	0	7,168,200	0
Lower Latham	South Platte	270,700,000	Laterals	270,700,000	0	270,700,000	0
Horse Creek	South Platte	740,520,000	Laterals			0	449,974,800
Prospect	South Platte	243,936,000	Laterals			0	152,460,000
Sand Creek	South Platte	78,408,000	Laterals			0	
Milton	South Platte	1,873,080,000				0	871,200,000
Carlin	South Platte	9,500,000				0	0
Duggan	South Platte	9,626,760				0	0

DISTRICT 3. DIVISION 1.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Warren Lake	Cache la Poudre	126,000,000	Warren Lake Outlet	45,000,000	24,000,000	3,500,000	60,000,000
Windsor Lake	Cache la Poudre	78,408,000	Windsor Lake Outlet	30,000,000	15,000,000	0	35,000,000
North Gray	Box Elder	12,000,000	Lake Canal	10,000,000	6,000,000	12,000,000	10,000,000
South Gray	Box Elder	22,293,000	Lake Canal	20,000,000	12,000,000	22,000,000	15,000,000
Chambers Lake	South Fork Poudre		Larimer Co. Canal	0	11,000,000	115,000,000	0
Reservoirs Nos. 2 and 3	Cache la Poudre	30,000,000	Larimer Co. Canal			0	0
Reservoir No. 4	Cache la Poudre	43,370,000	Larimer Co. Canal	30,000,000		30,000,000	35,000,000
Spring Canon	Spring Canon Creek	2,683,000	Spring Canon Outlet	2,000,000		2,000,000	2,000,000
Reservoir No. 1	North Fork Poudre	29,346,000	Reservoir No. 1 Outlet	23,000,000	19,000,000	20,000,000	24,000,000
Claymore Lake	Cache la Poudre	39,000,000	Pleasant Valley and Lake Canal	25,000,000	2,000,000	30,000,000	10,000,000
Reservoir No. 1	Box Elder	24,830,000	Reservoir Outlet		10,000,000	10,000,000	10,000,000
Richards	Cache la Poudre	46,000,000	Larimer Co. Canal			0	35,000,000
Reservoir No. 2	Box Elder	8,500,000	Reservoir Outlet		4,000,000	5,000,000	5,000,000
Reservoir No. 3	North Fork Poudre	125,000,000	Reservoir Outlet	90,000,000	24,000,000	80,000,000	100,000,000
Caverly	North Fork Poudre	7,500,000	Reservoir Outlet			0	0
Curtis Lake	Cache la Poudre	34,000,000	Larimer Co. Canal			20,000,000	25,000,000
Dixon Canon	Dixon Canon Creek	19,500,000	Reservoir Outlet	5,000,000		0	5,000,000
Reservoir No. 4	Box Elder	11,000,000	Reservoir Outlet			0	0
Reservoir No. 3	Box Elder	34,500,000	Reservoir Outlet			5,000,000	5,000,000
Stutchell	North Fork Poudre	3,056,000	Reservoir Outlet			0	0
Jameson Lake	Box Elder	3,500,000	Reservoir Outlet			0	0
Mitchell Lake No. 1	Lone Pine	25,280,000	Laramie-Poudre	0	5,000,000	0	4,000,000
Mitchell Lake No. 2	Lone Pine	4,370,000	Laramie-Poudre	0		0	2,000,000
Mitchell Lake No. 3	Lone Pine	4,330,000	Laramie-Poudre	0		0	0
Reservoir No. 4	North Fork Poudre	46,766,000	Reservoir Outlet	40,000,000		50,000,000	75,000,000
Reservoir No. 2	North Fork Poudre	169,000,000	Reservoir Outlet	100,000,000		110,000,000	140,000,000
Larimer and Weld	Cache la Poudre	390,000,000	Larimer and Weld	390,000,000	100,000,000	245,000,000	265,000,000
Windsor	Cache la Poudre	800,000,000	Cache la Poudre	330,000,000	71,000,000	190,000,000	580,000,000
Reservoir No. 1	Cache la Poudre	206,000,000	Larimer Co. Ditch	180,000,000	150,000,000	180,000,000	190,000,000
Long Pond	Cache la Poudre	176,000,000	Larimer Co. Ditch	95,000,000	45,000,000	150,000,000	160,000,000
Lindenmeier Lake	Cache la Poudre	40,000,000	Larimer Co. Ditch	10,000,000	11,000,000	30,000,000	20,000,000
Cache la Poudre	Cache la Poudre	415,000,000	Cache la Poudre	365,000,000	130,000,000	415,000,000	310,000,000
Wood	Seepage and flood	140,000,000	Wood Outlet	40,000,000		0	80,000,000
Reservoir No. 2	Drain Ditch	106,000	Reservoir Outlet			0	0
Reservoir No. 5	Cache la Poudre	250,000,000	North Poudre			0	0
Neece	Flood water	6,000,000	Neece	2,000,000		0	1,400,000
Reservoir No. 1	Cooper & Ames Slough	35,000,000	Lake Canal	10,000,000		11,000,000	5,000,000
Dowdy	Lone Pine	15,145,000	Laramie-Poudre			0	4,000,000
Reservoir No. 6	Cache la Poudre	445,000,000	North Poudre			0	200,000,000
Deer Lake	Lone Pine	3,850,000	Laramie-Poudre			0	0
Fossil Creek	Cache la Poudre	503,000,000	North Poudre	328,000,000	82,000,000	470,000,000	452,000,000
Erie Lake	Lone Pine	3,000,000	Laramie-Poudre			0	0
Douglas	Cache la Poudre	460,000,000	Larimer and Weld	25,000,000	12,000,000	0	100,000,000
Coal Creek	Box Elder	178,400,000	Cactus Hill	60,000,000		0	80,000,000
Reservoir No. 3	Soldier Canon	31,000,000	Reservoir Outlet			5,000,000	10,000,000
Big Beaver	Beaver Creek	69,201,000	Water for sale	0		0	40,000,000
Twin Lakes	Lone Pine	1,708,000	Laramie-Poudre			0	0
Reservoir No. 8	Cache la Poudre	670,000,000	Larimer and Weld	0		0	250,000,000

DISTRICT 3. DIVISION 1—Concluded.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Cameron Pass	Joe Wright Creek	34,000,000	Poudre Valley	0		0	0
Black Hollow	Cache la Poudre	250,000,000	Larimer Co.	25,000,000		0	195,000,000
Tenny	Cache la Poudre	15,000,000	Mountain supply			2,000,000	6,000,000
Reservoir No. 2	Cache la Poudre	6,500,000	Mountain supply			4,000,000	3,000,000
Bubble	Cache la Poudre	9,750,000	Mountain supply			6,000,000	4,000,000
Halligan	North Poudre	279,000,000	North Poudre	13,000,000	2,000,000	0	0
Reservoir No. 15	North Poudre	240,000,000	North Poudre			0	30,000,000
Sheep Creek	Sheep Creek	20,000,000	Water for sale	0		0	0
Lake Agnes	Zimmerman Creek	5,000,000	Water for sale	0		0	0
Timber line	Beaver Creek	33,000,000				0	0
Elder	Cache la Poudre	100,000,000				0	40,000,000
Portner	Fossil Creek and Cache la Poudre					0	19,000,000

DISTRICT 4. DIVISION 1.

Home Supply	Big Thompson	400,000,000	Home Supply	300,000,000	0	300,000,000	300,000,000
Mariano	Big Thompson	200,000,000	Home Supply	100,000,000	0	200,000,000	150,000,000
Lake Loveland	Big Thompson	625,000,000	Loveland and Greeley	200,000,000	25,000,000	80,000,000	513,669,585
Welch Lakes	Big Thompson	300,000,000	Handy Ditch	50,000,000	0		
Seven Lakes	Big Thompson	212,000,000	Loveland and Greeley	50,000,000	0	150,000,000	300,000,000
Boyd Lake	Big Thompson	1,873,000,000	Exchange	1,000,000,000	711,532,000	200,000,000	400,000,000
Ryan Gulch No. 1	Big Thompson	40,000,000	South Side	30,000,000	10,000,000		40,000,000
Lawn Lake	Roaring Fork	40,000,000	Farmers'				40,000,000
Boulder and Larimer	Little Thompson	319,895,000	Boulder and LarimerCo.				300,000,000
Ryan Gulch No. 2	Seepage	42,000,000	Exchange				42,000,000
Donath	Big Thompson	40,000,000	Loveland and Greeley			40,000,000	40,000,000

DISTRICT 5. DIVISION 1.

Pleasant Valley	St. Vrain	110,310,055	Rough and Ready	0	0	100,000,000	100,000,000
Knoths Lake	St. Vrain	2,000,000	Hansen's Private	0	0	500,000	1,500,000
Highland No. 1	St. Vrain	125,071,248	Highland	0	0	100,000,000	100,000,000
Highland No. 2	St. Vrain	105,280,000	Highland	0	0	50,000,000	100,000,000
Highland No. 3	St. Vrain	71,023,000	Highland	0	0	50,000,000	40,000,000
Ish Lake	Little Thompson	416,000,000	Mead Lateral and Farmers' Ex.	0	0	416,201,000	416,201,000
McIntosh Lake	St. Vrain	107,153,830	Oligarchy	0	0	100,000,000	100,000,000
Union	St. Vrain	850,000,000	Union (Dist. 2)	735,661,440	0	300,000,000	850,000,000
Burch Lake	St. Vrain	76,811,437	Oligarchy	0	0	50,000,000	20,000,000
Gold Lake	South St. Vrain	19,000,000	Left-hand	0	0	5,000,000	10,000,000
Crystal Lake	South St. Vrain	1,033,000	Private Ditches	0	0	40,000	1,000,000
Clover Lake	Dry Creek, Lykins Gulch and St. Vrain	25,962,250	Clover Basin	3,447,320	655,640	5,000,000	20,000,000
Beaver Park	Beaver Creek	123,000,000	Highland and Supply	92,860,000	0	1,000,000	1,000
Foot Hills	St. Vrain	184,629,820	Oligarchy			0	109,146,400
Highland Lake	St. Vrain	24,452,500	Private Ditches	0	0	20,000,000	22,000,000

DISTRICT 6. DIVISION 1.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Marshall Lake	South Boulder	80,000,000	Community	0	600	15,000,000	50,500,000
Westlake	South Boulder and Coal Creeks	30,452,087		0	0	200,000	25,000,000
Section 17	Coal Creek	1,475,812			0	0	75,000
Section 19	Coal Creek	3,520,000			0	520,000	2,500,000
Section 15	Coal Creek	767,900			0	0	10,000
Section 35	Coal Creek	2,500,100			0	0	50,000
Section 11	Boulder and Coal Creeks	3,588,056			0	0	10,000
McKay Lake	Boulder and Coal Creeks	41,678,208			0	0	25,678,000
Erie	South Boulder Creek	5,206,750	Erie	206,800	2,000,500	150,000	3,400,000
Louisville	South Boulder Creek	7,221,580	Louisville	200	300	220,000	4,000,000
Lafayette No. 1	South Boulder Creek	614,685	Lafayette	0	0		
Lafayette No. 2	South Boulder Creek	892,600	Lafayette	0	0		
Harper	South Boulder Creek	2,713,450	Harper	50	25		
Hiram Prince	South Boulder Creek	3,522,250	Prince	200	100	0	500,000
Waneke No. 1	South Boulder Creek	172,150	Miller	0	0		
Silver Lake	North Boulder Creek	35,164,124	Silver Lake	35,000,000	15,000,000	30,000,000	35,000,000
Island Lake	North Boulder Creek	16,196,629	City of Boulder	15,250,000	5,000,000	20,000,000	25,000,000
Goose Lake	North Boulder Creek	30,706,608	City of Boulder	15,500,000	10,000,000	500,000	10,000,000
Panama No. 1	Boulder Creek	304,920,000	Panama	20,500,000	200	304,000,000	204,000,000
Panama No. 3	Boulder Creek	196,000,000	Beasley and White Rock	45,950,000	150,000,000	196,000,000	100,000,000
Teller No. 5	South Boulder Creek	4,625,599	Teller	500	850		
Teller No. 4	South Boulder Creek	730,990	Teller	900	800		
Teller No. 1	South Boulder Creek	1,994,720	Lake	50,500	50,000		
Base Line	South Boulder Creek	130,680,000	Cole Ridge	0	0	90,000,000	100,500,000

DISTRICT 7. DIVISION 1.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	1911 May 1	1911 Nov. 1	1912 May 1	1912 Nov. 1
Loch Lomond Nos. 1, 2, 3, 4, 5, 6	Fall River and tributaries	17,424,000	Golden City and Ralston	17,424,000	10,000,000	17,424,000	17,424,000
Ward Nos. 1, 2, 3	Clear Creek	54,583,800		0	20,000,000	45,000,000	45,000,000
Lee & Halleck Nos. 1, 2, 3, 4, 5	Clear Creek	11,158,200		0	7,000,000	8,000,000	9,500,000
Bancroft & Joint Nos. 1,2,3	Clear Creek	9,147,600		0			
Copeland & Berkeley	Clear Creek	16,500,000		5,200,000	7,500,000		
Church	Clear Creek	13,068,000		7,500,000	7,500,000	7,000,000	11,000,000
Wilbur	Clear Creek	26,136,000		8,000,000	5,500,000	15,000,000	26,136,000
Groves & Dollison	Clear Creek	21,780,000		4,400,000	5,100,000	12,000,000	21,780,000
Gay	Clear Creek	3,484,000		1,500,000		1,500,000	3,000,000
Legault Nos. 1 and 2	Clear Creek	17,429,000		8,500,000	3,500,000	8,000,000	17,000,000
Yocky	Clear Creek	5,429,000		2,700,000	2,700,000	3,000,000	5,000,000
Shoup & Hackberry Nos. 1, 2, 3, 4, 5	Clear Creek	15,463,800		8,000,000	11,000,000	12,000,000	12,500,000
Broad-Small-Leyden Nos. 1, 2, 3	Clear Creek	225,624,800		150,000,000	20,000,000	180,000,000	175,000,000
Lathrop Nos. 1, 2, 3, 4	Clear Creek	18,295,200		8,800,000	12,000,000	12,225,000	15,000,000
Calkins	Clear Creek	16,998,400		1,800,000	3,000,000	12,000,000	14,000,000
Church & Williams	Clear Creek	7,456,000		1,500,000	4,000,000	6,000,000	7,000,000
Hussey, Rankin & Burnett	Clear Creek	18,295,200		3,000,000	9,000,000	11,500,000	13,000,000

DISTRICT 7. DIVISION 1—Concluded.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Harrington	Clear Creek	9,147,600		2,000,000		5,000,000	6,000,000
Frey, Vogel & Hintz	Clear Creek	15,246,000		6,700,000	3,000,000	7,500,000	9,000,000
Croke Nos. 1, 2, 3, 4, 5	Clear Creek	39,204,000		4,000,000	12,000,000	20,000,000	30,000,000
Hussey, Finnerty & Brawer	Clear Creek	10,454,400		2,000,000	2,500,000	4,000,000	7,000,000
Brown & Webster	Clear Creek	20,908,800		10,500,000	12,000,000	8,000,000	14,500,000
Halleck, Smith & Brown	Clear Creek	23,344,400		4,500,000	5,000,000	5,000,000	8,500,000
East Lakes Nos. 1, 2, 3, 4	Clear Creek	52,272,000		10,500,000	16,000,000	25,000,000	40,000,000
Ohio Nos. 1, 2	Clear Creek	23,958,000		9,000,000	8,000,000	15,000,000	18,000,000
Johnson, Poits & Brown	Clear Creek	16,552,000		4,000,000	5,000,000	8,276,400	12,000,000
Wadley	Clear Creek	13,939,200			3,000,000	5,000,000	10,000,000
Neresheimer & Richardson	Clear Creek	26,136,000		8,000,000	2,500,000	11,000,000	18,000,000
Porter & Myers Nos. 1, 2, 3	Clear Creek	26,086,800		6,000,000	3,000,000	10,000,000	16,000,000
Tucker	Ralston Creek	78,408,000				50,000,000	60,000,000
Standley Lake	Clear Creek	3,464,800,000	Bull and Nivens			696,960,000	1,067,220,000
Copelands Nos. 1, 2	Clear Creek	12,500,000					10,000,000
Bromley	Clear Creek	8,712,000				4,000,000	6,500,000
Smith	Clear Creek	7,840,800				3,000,000	5,000,000
Lakes	Clear Creek	20,200,000				12,000,000	18,000,000
Long Lakes Nos. 1, 2	Ralston Creek	47,916,000					47,916,000
Westminster	Clear Creek	10,890,000				4,000,000	6,000,000

DISTRICT 8. DIVISION 1.

Castlewood	Cherry Creek	250,000,000	Arapahoe Canal	229,000,000		175,633,920	35,152,920

DISTRICT 9. DIVISION 1.

Harriman	Bear and Turkey Creeks	38,000,000	Johnson Ditch	6,098,400	32,000,000	33,000,000	38,000,000
Soda Lake No. 1	Bear Creek	10,500,000	Arnett Ditch	2,178,000		5,000,000	10,000,000
Soda Lake No. 2	Bear Creek	76,860,000	Arnett Ditch	7,840,800		10,000,000	70,860,000
Bowles	Bear Creek	76,000,000	Bowles	8,712,000	6,621,120	70,000,000	76,000,000
Johnston	Bear Creek	11,200,000	Dutch Creek	2,616,600		3,733,333	11,200,000
Stickford	Bear Creek	450,000	Rucker	435,600	200,000	300,000	1,000,000
Henry	Bear Creek	6,600,000	Henry	7,744,400		1,650,000	6,000,000
Henry Lake	Bear Creek	8,700,000	Lake	2,178,000	1,178,000	5,000,000	8,000,000
Ft. Logan	Bear Creek	348,480	Ft. Logan			100,000	348,480
Rucker	Bear Creek	1,100,000	Rucker	174,240		1,000,000	1,100,000
Grant No. 1	Bear Creek	3,000,000	Grant	1,306,800		375,000	4,900,000
Grant No. 2	Bear Creek	3,200,000	Grant	435,600		0	3,200,000
Grant No. 3	Bear Creek	4,900,000	Grant	696,960		0	1,100,000
N. B. Coy No. 1	Bear Creek	1,100,000	N. B. Coy	435,600		1,100,000	1,100,000
N. B. Coy No. 2	Bear Creek	300,000	N. B. Coy	130,680		300,000	300,000
Bowles Nos. 2, 3, 4	Bear Creek	20,691,000	Bowles	20,691,000	10,345,500	20,691,000	20,691,000
Marston	Bear Creek	853,200,000	Filters	10,890,000	50,050,440	305,168,115	566,280,000
Bergen No. 1	Turkey Creek	16,345,300	Bergen	1,035,440		8,000,000	8,172,650
Bergen No. 2	Turkey Creek	24,984,500	Bergen	871,200		6,246,000	12,492,250
Brooks	Turkey Creek	435,600	Brooks			0	435,600
Dean	Turkey Creek	17,424,000	Dean			0	13,068,000
J. B. Grant No. 1	Turkey Creek	4,356,000	Grant			0	1,000,000
J. B. Grant No. 2	Turkey Creek	522,720	Grant			0	0

DISTRICT 9. DIVISION 1—Concluded.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Shearer	Turkey Creek	4,356,000	Shearer			0	1,250,000
Reservoir No. 7	Turkey Creek	784,080				520,270	392,040
Shepard	Turkey Creek	2,439,360	Shepard			0	0
Gulch	Turkey Creek	4,210,252	Gulch			2,105,125	2,000,000
Rollins No. 1	Bear Creek	3,484,800	Rollins			200,000	3,484,800
" No. 2	Bear Creek	653,400	Rollins			653,400	653,400
Kendrick	Bear Creek	5,227,220	Kendrick			2,000,000	3,225,000
Ward & Kendrick	Bear Creek	17,424,000	Ward & Kendrick	522,720		5,800,000	17,000,000
Smith	Bear Creek	15,424,000	T. Green			5,211,000	15,422,000
Porter	Bear Creek	522,720	Porter			0	522,720
Deutcher & Reynolds	Bear Creek	3,267,000	Deutcher			0	3,266,280

DISTRICT 11. DIVISION 2.

Boss Lake	Springs and drainage	26,832,960	So. Arkansas River	26,832,960	2,000,000	26,832,960	
Sugar Loaf	Lake Fork Arkansas	738,227,100	Arkansas River	501,887,540	512,464,666	328,600,000	350,840,200
Clear Creek	Clear Creek	409,537,600	Otero Canal	153,285,200	6,365,300	268,111,800	281,702,502
Twin Lakes	Lake Creek		Colorado Canal				
Evans Gulch	Evans Gulch	1,429,000	City of Leadville	479,666	959,332	1,000,000	725,000
Big Evans Gulch No. 2	Evans Gulch	2,000,000	Stevens & Leiter	2,000,000	2,000,000	2,000,000	775,000
Mountain Lake	Springs and drainage	5,333,333	Evans Gulch	3,000,000	5,333,333	3,000,000	5,333,333

DISTRICT 12. DIVISION 2.

Schaeffer	Beaver Creek	137,151,400	Beaver W. & Irr. Co.	81,000,000	10,000,000	68,800,000	115,000,000
Skagway	Beaver Creek	144,000,000	Power	65,160,000	84,210,000		126,000,000
Victor No. 2	W. Beaver, E. Branch	9,105,000	City of Victor	13,200,000	13,200,000	2,000,000	9,000,000
Victor Bison Basin	W. Beaver, E. Branch	45,500,000	City of Victor			0	9,000,000
Cripple Creek No. 1	W. Beaver Creek	16,600,000	City of Cripple Creek				14,000,000
Cripple Creek No. 2	W. Beaver Creek	6,600,000					0
Colo. Springs Nos. 2, 4, 5	Middle Beaver Creek		Colorado Springs				60,000,000
Colo. Springs Nos. 7, 8	W. Beaver, E. Branch			146,000,000	150,000,000		29,924,000
Mt. Pisgah	Four Mile Creek		Garden Park & O'Brien	27,000,000	0	12,600,000	32,000,000

DISTRICT 13. DIVISION 2.

Thos. Balman Lake Creek	Lake Creek	2,592,000	Price & Abbott			2,592,000	0

DISTRICT 14. DIVISION 2.

Lake Henry	Arkansas River	276,823,800	Sugar City Lateral	30,492,000	0	174,240,000	
Greenview	Fountain Creek	2,613,600	Greenview				
Pueblo Water Co. No. 1	Arkansas River	679,000	City of Pueblo				
Pueblo Water Co. No. 2	Arkansas River	767,180	City of Pueblo				
Pueblo Water Co. No. 3	Arkansas River	955,441	City of Pueblo				
McElroy	Fountain Creek	150,000					
Pueblo Water Works	Arkansas River	1,740,000	City of Pueblo				
Pueblo Water Works No. 2	Arkansas River	1,760,000	City of Pueblo				
Bessemer No. 9	Arkansas River	38,500,000	C. F. & I.				
Turkey Creek	Turkey Creek	30,000,000	Turkey Creek				21,922,150
Lake Meredith	Arkansas River	871,200,000				251,360,000	87,120,000

DISTRICT 15. DIVISION 2.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Minnequa	Drainage	60,000,000	C. F. & I.	51,400,000	51,400,000	51,390,000	53,654,000
Sarvard	Arkansas River	69,000,000	C. F. & I.	53,000,000	52,487,000	52,983,000	51,355,000
Corwin	Arkansas River	141,000,000	C. F. & I.	49,000,000	139,000,000	48,992,000	133,026,000

DISTRICT 16. DIVISION 2.

Cucharas No. 5	Cucharas River	809,216,000	Pueblo-Rocky Ford			48,351,600	64,643,040
Bradford Lake	Huerfano River	1,843,459,200	Pueblo-Rocky Ford			93,562,840	201,158,080

DISTRICT 17. DIVISION 2.

Lake No. 1	Arkansas River	326,700,000	Lake (Holbrook)	87,120,000		326,700,000	174,240,000
Lake No. 2 (Dye)	Arkansas River	196,020,000	Lake (Holbrook)			196,020,000	87,120,000
Horse Creek	Arkansas River & Horse Creek	1,171,163,000	Ft. Lyon	98,010,000		266,717,880	
Adobe Creek	Arkansas River & Adobe Creek	2,682,207,000	Ft. Lyon				958,320,000
Timpas Creek. No. 2	Timpas Creek	128,585,000	Lateral No. 2		8,712,000		15,519,000
Timpas Creek. No. 3	Timpas Creek	79,725,000	Lateral No. 3				664,000
Red Top	Mustang Creek	26,136,000	Red Top		1,842,400		
Hardesty	Mustang Creek	6,846,360	Hardesty		2,178,000		
Brown (Mustang)	Mustang Creek	144,000,000	Lateral		2,178,000		
Swink No. 1	Apishapa River	100,318,680	Lateral No. 1				
Swink No. 2	Apishapa River	12,107,800	Lateral No. 2				
Box Springs	Horse Creek	162,000,000	Box Springs				26,136,000
Thurston	Arkansas River	348,480,000	Ft. Lyon		21,780,000	87,120,000	174,240,000
Nee Skah (Queen)	Arkansas River	1,120,276,080	Pawnee, Comanche, Ft. Lyon & Amity	57,237,840			209,262,240
Nee Noshe	Arkansas River	3,195,578,720	Comanche & Amity	286,886,160		286,886,160	711,378,360
Nee Sopah	Arkansas River	1,109,908,800	Comanche & Amity				
Nee Gronda	Arkansas River	2,556,328,000	Comanche & Amity	1,059,117,840	872,071,200	386,987,040	297,255,320

DISTRICT 21. DIVISION 3.

La Jara	La Jara River	653,400,000	Garcia	342,480,000	435,600,000	522,720,000	392,040,000
Terrace	Alamosa River	435,600,000	Terrace Canal			0	0

DISTRICT 22. DIVISION 3.

Cove Lake	Conejos & San Antonio Rivers	250,000,000		250,000,000		250,000,000	

DISTRICT 23. DIVISION 1.

Cheesman Lake	So. Platte River, LostPark Creek	3,444,038,412		3,147,755,394	2,603,165,006		
Antero	So. Platte River	2,552,654,986	No. Colo. Irr. Co's	124,240,000	428,422,000		
Lake George	So. Platte River	32,000,000		32,000,000	32,000,000	32,000,000	32,000,000
Wellington	Buffalo Creek						

DISTRICT 24. DIVISION 3.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Sanches	Culebra River—Ventero, Vallejos, San Francisco, Torcido, Jaroso, Cuates and Willow Creeks	4,493,450,605	Culebra & Eastdale Canal				
Eastdale No. 1	Culebra & Costilla Rivers	150,975,000	Laterals No. 5-6	69,696,000			
Eastdale No. 2	Culebra & Costilla Rivers	132,468,000	Lateral No. 4	43,560,000			
Mesita	Culebra River	113,531,887	Laterals No. 7 & 8	50,246,000			
Salazar	Rito Seco	5,341,151		5,341,000	3,560,700		
DISTRICT 26. DIVISION 3.							
Saguache	Flood water				1,638,916		
DISTRICT 39. DIVISION 5.							
Grass Valley or Antlers	E. Br. of Rifle Creek	174,244,356	Grass Valley Canal or Antlers Ditch			113,256,000	30,492,000
DISTRICT 40. DIVISION 4.							
Surface Cr. Ditch & Res. Co.	Natural drainage	350,000,000	Surface Creek	350,000,000			
Battlement Mesa	Natural drainage	3,615,840	Cedar Park	3,615,840			
Grandy Ditch & Res. Co.	Natural drainage	17,556,960	Grandy	17,556,960			
Doctor's	Natural drainage	1,296,000	Doctor's	1,296,000			
DISTRICT 42. DIVISION 4.							
Bull Creek Nos. 1, 2, 3, 4, 5	Snow	8,455,600 (Total water to ditches on	All ditches on Bull Creek run from Bull Creek Res. Bull Creek)	0	0		
Dry Lake	Snow	26,000,000	Juanita	0	0		
Highlands Nos. 1, 2	Snow		Highlands	0	0		
Crane Lake	Snow		Juanita	0	0		
Deep Creek No. 1	Snow			0	0		
Deep Creek No. 2	Snow	38,977,491	All ditches on Kannah				
Grand Mesa Res. Co. No. 1	Snow		Creek	0	0		
Grand Mesa Res. Nos. 8, 9	Snow	(Total water r	un from Grand Mesa Res-				
Scales & Upper Scales	Snow	ervoir Co.'s S nah Creek)	ystem to ditches on Kan-				
No. 1	Mesa Creek and snow	27,714,860	All ditches on Mesa Creek	Full	0		
No. 2—Fish Lake		(Total water r	un from these Res. to	Part Full	0		
No. 3—Dog Lake		ditches on Me	sa Creek).	0	0		
Coon Creek Res. Co. System	Snow and creek water	11,444,872	All ditches on Cotton-	Part Full	Part Full		
Cottonwood Nos. 1, 2, 4, 5		52,549,277	wood Creek	0	0		
Parker Basin Nos. 1, 2, 3		(Total water r Co.'s System)	un from Cottonwood Res.				
Big Reservoir No. 1	Grand Mesa watershed						
Atkinson or No. 3							
Forty Acre or No. 4		192,942,010	All ditches out of Big				
Silver Lake or No. 5			Creek except No. 1	Filling	0		
Englehart or No. 6							
Bonham or No. 7							

DISTRICT 44. DIVISION 5.

NAME OF RESERVOIR	SOURCE OF SUPPLY	Capacity in Cubic Feet	Ditch Supplied from Reservoir	QUANTITY OF WATER IN RESERVOIR—CUBIC FEET			
				1911		1912	
				May 1	Nov. 1	May 1	Nov. 1
Dry Lakes	Surface Creek						
Martin's	Martin's Creek		Private Ditch				
Wyman's	Little Beaver Creek		Private Ditch				
Dunston							

DISTRICT 58. DIVISION 5.

W. E. Wheeler	Lake Creek	1,600,000	Wheeler No. 3			1,600,000	1,600,000
Gardner Park	Snow & springs	47,916,000	Stillwater			40,000,000	28,000,000

DISTRICT 60. DIVISION 4.

Lone Cone	Naturita Creek	91,000,000	Lone Cone	14,000,000	0		
Gurley	Beaver Creek	30,000,000	Gurley	Nearly Full	Nearly Full		

DISTRICT 64. DIVISION 1.

Jumbo	South Platte River	1,235,000,000	Highline, Peterson, Settlers	125,000,000	9,720,000		

DISTRICT 65. DIVISION 1.

W. E. Wolf	Olive Creek	2,178,000		3,500,000	3,500,000	2,000,000	2,000,000
J. H. Rosencrans	Dry Willow Creek	14,000,000		9,500,000	9,500,000	477,042,000	477,042,000
E. J. Dowling	Rush Creek	3,200,000		3,100,000	3,100,000	1,690,000	1,740,000
R. S. Pike	Springs	2,917,213		2,900,000	2,900,000	2,445,213	2,945,213
George Short	Holy Joe Creek	1,524,000		0	600,000	905,500	1,500,500

DISTRICT 68. DIVISION 4.

Burrow Creek No. 1	Burrow Creek	1,364,437	Taft and White	1,364,437			
Burrow Creek No. 2	Burrow Creek	970,662	Taft and White	970,662			

DISTRICT 70. DIVISION 5.

McDowell No. 1	Roan Creek	696,960	Reservoir	696,960	696,960	696,960	696,962
Meyers	Roan Creek	174,240	Roan Creek	86,000	86,000	174,240	174,240
Reservoir No. 1	Boldt Spring	135,000	Boldt Ditch			135,000	135,000
Harris	Flood water	174,240	Reservoir			174,240	174,240
Conwell	Con Creek	348,480	Conwell			348,480	348,480

CHAPTER VII.

RESERVOIRS UNDER CONSTRUCTION AND PLANS APPROVED

Rock Creek Reservoir

This reservoir is located in Section 6, Township 1 South, Range 60 West, and Section 31, Township 1 North, Range 60 West, 6th Principal Meridian, on the head waters of Rock creek, a tributary of Kiowa creek, which in turn flows into the South Platte river. The reservoir lies partly in Adams and partly in Morgan counties.

It has a capacity of 470 acre-feet, and is formed by the construction of an earth dam across Rock creek.

The dam has a maximum height of thirty feet and a length of 1,600 feet on the crest. The embankment has a width of ten feet on the crest, an inside slope of 3:1 and an outside slope of 2:1. The inner slope is protected by a rock riprap. The outlet consists of a single line of vitrified pipe ten inches in diameter entirely surrounded by concrete one foot thick, and provided with concrete cut-off walls at 20-foot intervals. This pipe is laid in a trench three feet deep in the natural earth.

The discharge is controlled by a sluice gate at the inner end of the conduit, the gate being operated from a wooden tower. The freeboard is five feet. At the west end of the dam there is a spillway fifty feet wide, and at the east end a second spillway twenty-five feet wide. As the entire drainage area tributary to the reservoir is rather less than seven square miles, the spillway capacity is ample.

Plans and specifications for this reservoir were prepared by Mr. A. W. Hill, and were approved by the State Engineer on January 19, 1911.

Some work was done during the summer of 1911, but on account of the small size of the reservoir it was not considered necessary to keep a State inspector on the work.

The State Engineer's office has not been notified of the completion of the reservoir.

Bradford Lake Reservoir No. 1

This reservoir is located in Township 26 South, Ranges 65 and 66 West, 6th Principal Meridian, in Huerfano county, Colorado, and is the property of The Pueblo-Rocky Ford Irrigation Company.

It is supplied through an inlet canal from the Huerfano river. It is formed by a natural basin, around portions of which a low earth embankment has been constructed. Its capacity is 40,520 acre-feet with a freeboard of four feet.

The embankment has a maximum height of fourteen feet, is forty feet wide on the crest, has an inside slope of 2:1 and an outside slope of 1½:1.

The outlet was constructed in a tunnel 400 feet long, at a depth of about thirty feet below the natural ground surface. This tunnel has a width of four feet and a height of six feet inside of the concrete lining, the discharge through it being controlled by a sluice gate at its inner end operated from a foot-bridge at the level of the top of the dam.

Two concrete cut-off walls are provided near the inner end of the conduit. They are spaced twenty feet apart and extend two feet outside of the conduit in all directions.

It is intended that the high-water line shall be kept four feet below the crest of the embankment, but no spillway has been provided, since there is practically no drainage immediately tributary to the reservoir and the quantity of water supplied is directly controlled by manipulation of the inlet canal headgates.

Plans and specifications for this work were prepared by Mr. W. J. Lester, Chief Engineer The Pueblo-Rocky Ford Irrigation Company, and were approved by the State Engineer on February 3, 1911.

Early in May, 1911, the construction work at Bradford Lake was examined by Mr. Julius Hornbein, State Inspector, under instructions from this office.

Following his report, the State Engineer directed a letter under date May 9, 1911, to The Pueblo-Rocky Ford Irrigation Company, formally approving and accepting the work in accordance with the provisions of Section 3205, Revised Statutes of Colorado, 1908.

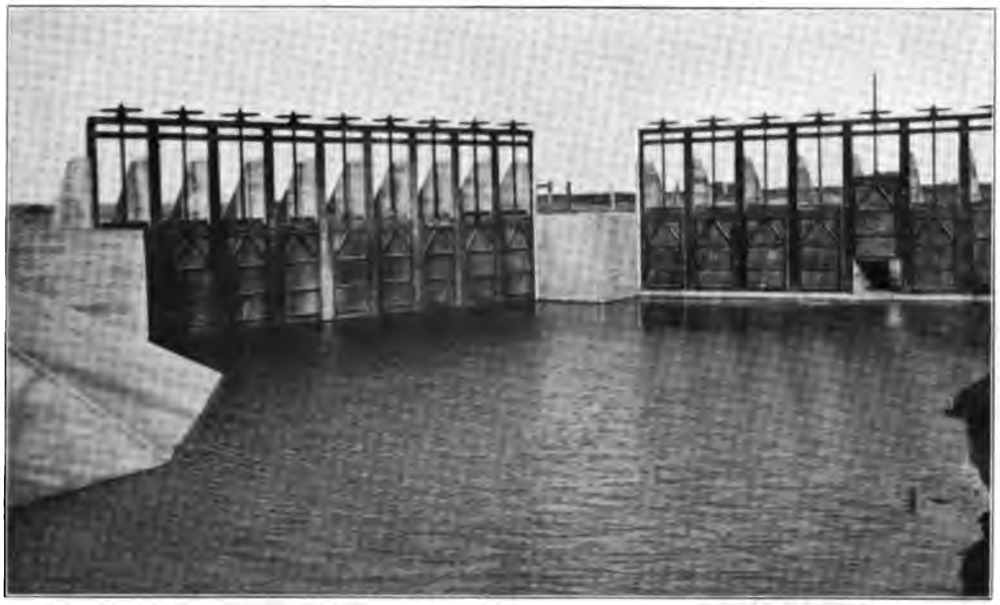
Sage Creek Reservoir

This reservoir is located in Section 13, Township 5 North, Range 88 West, 6th Principal Meridian, in Routt county, Colorado.

It is formed by the construction of an earth embankment across Sage creek in Water District No. 57.

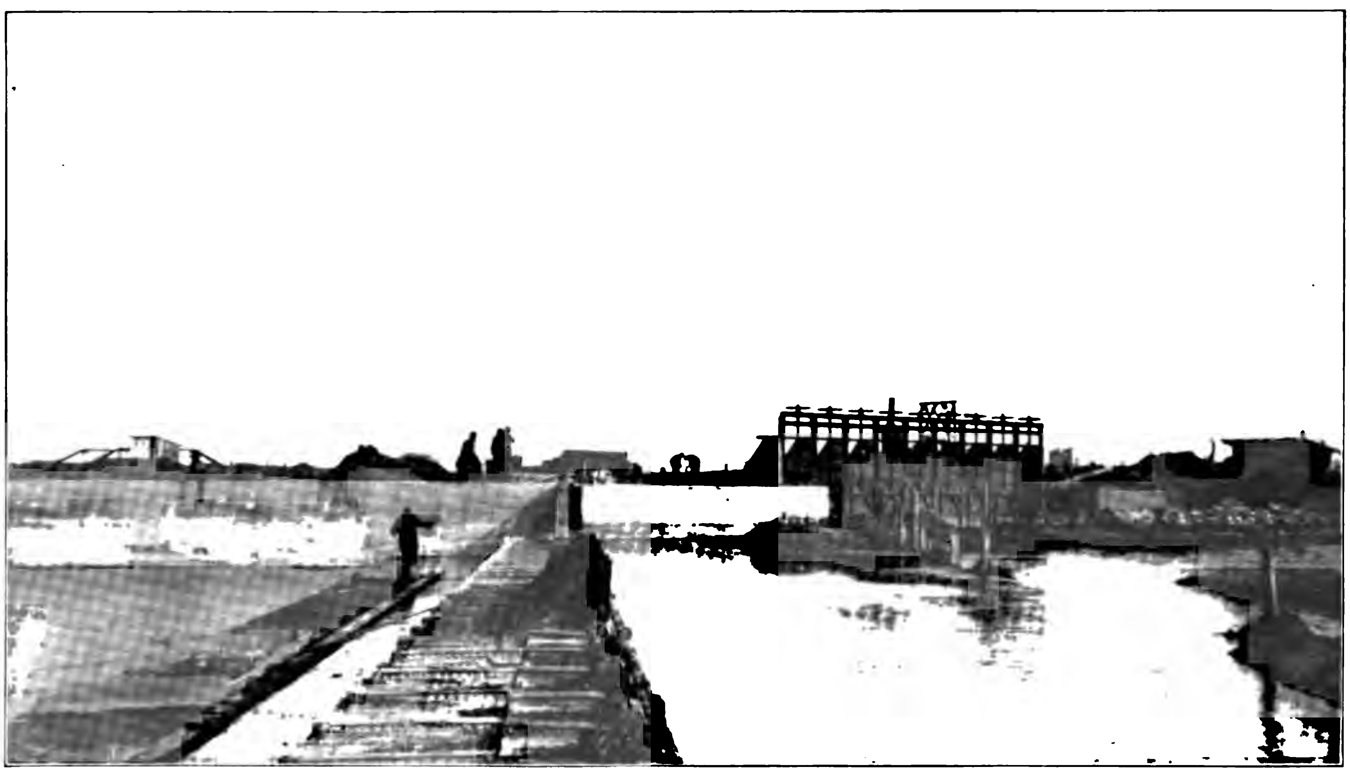
The first plan submitted, which was approved on April 20, 1911, provided for an embankment having a maximum height of thirty-five feet and a length of 464 feet on the crest. The embankment section was ten feet wide on the crest and had inside and outside slopes of 3:1 and 2:1, respectively. The inner slope was protected by a brush mattress eight inches thick.

The outlet conduit consisted of a single line of cast iron pipe sixteen inches in diameter, laid on a continuous bed of concrete two feet wide and extending sixteen inches below the center of the pipe. This conduit was laid in a



PREWITT RESERVOIR

The Prewitt Reservoir & Land Company. Bifurcation Works on Inlet Canal. Capacity, 690 Cubic Feet per Second. J. C. Ulrich, Consulting Engineer



PREWITT RESERVOIR

The Prewitt Reservoir & Land Company. Diversion Dam and Headgates on South Platte River. Capacity, 690 Cubic Feet per Second. J. C. Ulrich, Consulting Engineer

trench excavated below the natural ground surface, the bottom of the conduit being thirty feet below the crest of the dam.

Two concrete cut-off walls, each two feet thick and extending five feet in every direction from the center of the pipe, were provided. One of these was located immediately under the crest of the dam and the other fifty feet nearer the inner toe.

The discharge from the reservoir was controlled by a cast-iron sluice gate located at the inner end of the conduit and operated by a screw and hand wheel from the top of a wooden tower.

The freeboard was five feet and a spillway eighteen feet wide was to be constructed in a cut around one end of the dam. This spillway was lined with concrete on the bottom and to a height of three feet on the side slopes.

Soon after construction work was begun the owner decided to construct a larger reservoir than was contemplated in the plans first submitted. The height of the embankment was, therefore, increased by ten feet, its length on the crest was increased to 559 feet, and the location of the spillway was changed to fit the increased dimensions of the embankment.

Rock riprap was substituted for the brush mattress originally designed for the protection of the inner slope.

The dimensions and details of the outlet conduit and of the spillway were not changed.

The specifications controlling character of work and methods of construction remained as before.

The plans, as modified to provide for the construction of the larger dam, were approved by the State Engineer on August 8, 1911.

The capacity of this reservoir is somewhat less than 1,000 acre-feet, and the drainage area immediately tributary to it is about ten square miles.

The reservoir is owned by D. L. Sellers, and all plans and specifications for its construction were prepared by The Routt County Engineering Company, of Hayden, Colorado.

On December 21, 1911, the engineer in charge reported that the outlet conduit had been completed and the embankment constructed to its full section to a height of twenty feet.

At that time work was discontinued for the winter, leaving about one-fourth of the total yardage to be placed, and the spillway to be constructed, in order to complete the reservoir.

No further reports have been received by the State Engineer.

Prewitt Reservoir

This reservoir is located in Townships 5 and 6 North, Ranges 53 and 54 West, 6th Principal Meridian, in Water District No. 64, and in Washington and Logan counties, Colorado.

It has a capacity of 32,824 acre-feet with a depth of water of twenty-eight feet above the bottom of the outlet. It is not located directly on a stream, but is supplied with water from the South Platte river through an inlet canal about five miles long.

It is a wide, shallow basin formed by the construction of an embankment about 18,000 feet long and with a maximum height of thirty-seven feet.

The embankment is sixteen feet wide on the crest, has an inside slope of 2: 1, an outside slope of 2: 1 for a vertical distance of twenty feet below the crest, and 3: 1 below that point.

The material of which the embankment is constructed contains an excess of fine sand, and is deficient in its content of clay or other binder. For this reason unusual care was taken in the construction.

The material was placed in layers less than one foot thick, was kept thoroughly wet, and was compacted with a heavy corrugated roller. Every precaution was taken to make the embankment as dense and compact as was possible with the material at hand.

For the same reason much more than ordinary care and expense in the protection of the inner slope was considered justifiable. A concrete toe-wall, six inches thick and extending five feet into the ground, was constructed at the foot of the inner slope. This was reinforced in both directions by three-eighths-inch square, twisted steel bars, placed one foot apart.

At the top of the slope a parapet wall, six inches thick, three feet high, and with a base of two and one-half feet, was constructed. This was reinforced in the same way as the toe-wall.

At intervals of ten feet along the slope concrete sills, six inches thick and twelve inches wide, were constructed, extending along the line of greatest declivity and connecting the toe-wall and the parapet wall. Each of these sills was reinforced longitudinally with three three-eighths-inch twisted bars.

The tops of these sills were made flush with the finished surface of the earth embankment, and on top of them were constructed slabs of concrete, four inches thick and extending from the foot to the top of the slope without a joint.

These slabs are reinforced with three-eighths-inch square, twisted bars, spaced twelve inches apart in both directions. Joints perpendicular to the axis of the dam are made over the sills previously described. There are no joints in any other direction.

This slope protection has been most carefully designed to avoid the defects which have appeared in the careless and slipshod concrete work which has, unfortunately, been all too common in Colorado.

The work itself has been done under the most careful and thorough inspection, and it is believed that it will be efficient and durable, and that it will afford absolute protection to the embankment.

The outlet conduit is a reinforced concrete structure having four rectangular tubes, each five feet high by two feet wide. At the inner end of this conduit is a concrete tower containing two complete sets of cast iron gates with their operating mechanism.

One set of gates is provided for ordinary operation and the other set for emergency, in case of accident to the first. The gates are operated by screws working through ball-bearing nuts, each nut being provided with a hand wheel.

As the cast iron gates bear against bronze liners, and as they are not subject to a very great water pressure, complicated and powerful lifting devices are not necessary.

The top of the gate tower is connected with the crest of the embankment by a steel foot bridge.

The entire outlet structure, including the gate tower, conduit and aprons, rests on a foundation of bearing piles twelve inches in diameter and sixteen feet long.

As there is no drainage area directly tributary to the reservoir, no spillway was considered necessary and none has been provided. It is, however, contemplated that a freeboard of not less than eight feet will be maintained at all times.

This reservoir was constructed by The Prewitt Reservoir and Land Company for the purpose of insuring ample water supply to some 30,000 acres of sugar beet land in Logan county.

Plans and specifications were prepared by and the work done under the immediate direction of Mr. J. C. Ulrich, consulting engineer, of Denver.

Plans were approved by the State Engineer on May 5 and November 18, 1911.

On November 15, 1912, the State Engineer made an examination of the completed work, and under date November 19, 1912, addressed a letter to The Prewitt Reservoir and Land Company formally approving and accepting the work in accordance with the provisions of Section 3205, Revised Statutes of Colorado, 1908.

Columbine Reservoir No. 2

This reservoir is located in Sections 23, 24, 25 and 26, Township 29 South, Range 68 West, 6th Principal Meridian, in Water District No. 16, Huerfano county, Colorado.

It has a capacity of about 2,300 acre-feet and is supplied with water from Wahatoya creek through the Stafford Intake ditch, Columbine reservoir No. 1 and Columbine ditch No. 1.

The dam is an earth embankment having a maximum height of sixty-eight feet and a length of 1,720 feet on the crest.

The crest width is sixteen feet, the inside slope 2:1 and the outside slope 3:1. The inner slope is protected by a rock riprap one foot thick.

The freeboard is five feet and a spillway is constructed in the natural rock near one end of the dam.

The outlet conduit consists of a line of thirty-inch cast iron pipe laid in a trench cut below the natural surface of the ground at an elevation sixty-three feet below the crest of the dam.

The pipe is laid with leaded joints, and a concrete cut-off wall, six feet square and eighteen inches thick, is constructed around the middle of each length of pipe.

The discharge is controlled by a standard gate valve at the lower end of the conduit, and an emergency valve is provided at the inner end, to be closed in the event of accident.

Plans were prepared by Messrs. Baker and Thompson, engineers, Greeley, Colorado, and approved by the State Engineer on June 6, 1911, with the condition that a cut-off wall be constructed near the inner toe and carried to bed rock or to an impervious substratum.

The State Engineer's office has not been advised whether the construction work on this reservoir has been completed.

Park Reservoir

This reservoir is located on West Elk creek, Section 19, Township 4 South, Range 91 West, 6th Principal Meridian, in Water District No. 39, Garfield county, Colorado.

It has a capacity of 200 acre-feet with a depth of water of twenty-eight feet above the bottom of the outlet. It is formed by the construction of an earth embankment across West Elk creek.

The embankment has a maximum height of thirty-nine feet and a length on the crest of 545 feet. The crest width is ten feet, the outside slope is 2:1, the inside slope is 2:1 above the high-water line and 2½:1 below.

The inner slope is protected by a rock riprap twelve inches thick.

Along the axis of the dam there is a cut-off trench excavated to an impervious substratum and filled with selected material carefully compacted in layers not more than six inches thick.

This selected filling is carried to a height of three feet above the natural surface of the ground.

The freeboard is five feet and a spillway with a capacity of 600 cubic feet per second is constructed around one end of the dam.

The outlet consists of a line of twelve-inch cast iron pipe laid on a concrete foundation two feet wide and extending from the center of the pipe to a depth of twelve inches.

Near the inner end of the conduit are two concrete cut-off walls, spaced about twenty-five feet apart. Each of these is twelve inches thick and extends two feet in every direction from the pipe.

The discharge from the reservoir is controlled by a standard gate valve at the lower end of the conduit.

The reservoir is the property of The West Elk Land and Livestock Company.

Plans and specifications were prepared by Messrs. Bull and Witham, consulting engineers, Denver, and were approved by the State Engineer on June 10, 1911.

The State Engineer's office has not been advised of the completion of the construction work.

Beckwith Reservoir

This reservoir is located in Section 23, Township 24 South, Range 67 West, 6th Principal Meridian, in Water District No. 15, in Pueblo county, Colorado.

It has a capacity of 2,500 acre-feet with a depth of water of thirty-seven feet above the bottom of the outlet, and receives water from Greenhorn creek through the Hayden canal.

The dam is an earth embankment having a maximum height of sixty feet and a length on the crest of 513 feet. The crest width is twenty feet, the inside slope is 3:1 and the outside slope 2:1.

The inside slope is protected from ten feet below high water line to five feet above by a rock riprap twelve inches thick.

About half way between the inner toe and the crest of the dam is a puddle trench excavated to an impervious substratum and with a width of four feet on the bottom and side slopes 1:1.

Immediately under the crest of the dam is a concrete cut-off wall, three feet thick, extending down to a water-tight stratum and up to a height of four feet above the natural ground surface.

Fifty-five feet below the center line of the dam a drain pipe of six-inch tile, 140 feet long, is laid on the natural surface parallel to the axis of the dam, and connected with another six-inch tile drain at right angles to the axis of the dam and extending beyond the lower toe.

No spillway has been provided since there is practically no tributary drainage area, and the water supplied to the reservoir is under absolute control at the gates of the inlet canal. It is expected, however, to maintain a freeboard of ten feet.

The outlet conduit consists of a single line of cast iron pipe sixteen inches in diameter, laid in a trench excavated below the natural ground surface.

Two concrete cut-off walls, each one foot thick by six feet in diameter, surround this pipe. One of them is located immediately under the crest of the dam and the other eighty feet nearer the inner toe of the embankment.

At the inner end of this conduit is a concrete valve tower, fifty-one feet high by six feet inside diameter, built on a foundation of bearing piles. The cast iron pipe passes through the bottom of this tower and the well is dry at all times.

Within the tower a standard gate valve is placed in the pipe line, and on the outside a sluice gate controls the admission of water. By means of this arrangement ready access may be had to the gate valve for examination or repairs.

Plans and specifications for this reservoir were prepared by Mr. D. G. Thomas, engineer, of Denver, and approved by the State Engineer on July 5, 1911.

The completion of the construction has not been reported to the State Engineer.

The Northfield Land and Water Company Reservoir No. 4

This reservoir is located in Sections 25, 26 and 36, Township 12 South, Range 68 West, 6th Principal Meridian, in Water District No. 10, El Paso county, Colorado.

It has a capacity of about 500 acre-feet and is formed by the construction of an earth embankment across the channel of West Monument creek.

The dam has a maximum height of fifty-seven feet and is 450 feet long on the crest. The crest width is fifteen feet, the outside slope 3:1 and the inside slope 2:1.

The inner slope is protected by a rock riprap from eight to ten inches thick.

The inner half of the embankment is constructed of the best selected material available near the site, while the outer half is constructed of coarser and more pervious materials.

Across the channel of the creek, immediately under the crest of the embankment, a concrete cut-off wall is constructed. This is founded on bed-rock and carried up to a uniform elevation forty-one feet below the crest of the dam.

The freeboard is nine feet and a spillway twenty feet wide is constructed in the rock at one end of the dam. This spillway is lined on the sides with six inches of concrete to a height of five feet.

The outlet conduit is a single line of steel pipe, eighteen inches outside diameter, laid in a trench excavated in solid rock at an elevation forty-nine feet below the crest of the embankment. This trench is thirty inches wide and is entirely filled with concrete underneath and on both sides of the pipe and to a height two feet above its top.

The discharge from the reservoir is controlled by a standard eighteen-inch gate valve with four-inch bypass, near the lower toe of the dam.

This gate valve is placed in a dry well, five feet inside diameter, constructed of reinforced concrete.

The reservoir is the property of The Northfield Land and Water Company and the water from it is used largely for domestic purposes.

Plans for its construction were prepared by Mr. G. H. Matthes, engineer, Colorado Springs, and approved by the State Engineer on July 20, 1911.

The State Engineer's office has not yet been advised of the completion of the work.

Foothills Reservoir

This reservoir is located in Sections 27, 33 and 34, Township 3 North, Range 70 West, 6th Principal Meridian, in Water District No. 5, Boulder county, Colorado.

It receives its water supply from St. Vrain creek through a feeder ditch having a capacity of 430 cubic feet per second.

Its capacity is 4,240 acre-feet with a depth of water of forty-five feet above the bottom of the outlet conduit, and the area of its high-water surface is 177 acres.

The dam is an earth embankment 3,150 feet long on the crest and with a maximum height of fifty-one feet. The crest width of the section is fifteen feet and inside and outside slopes are $2\frac{1}{2}:1$.

The location is well up in the hills where suitable material for an earth dam is not plentiful, and care was, therefore, used to select the material in such a way that the most impervious should be placed on the inside of the center line and the coarser material on the outside. This arrangement tends to prevent loss of water through the embankment itself, and at the same time facilitates drainage of the outer half of the embankment.

About thirty feet from the inner toe of the embankment a trench was excavated to the underlying shale, which is practically impervious, and this trench was filled with selected and carefully puddled material. The trench was six feet wide on the bottom with side slopes of $\frac{1}{2}:1$.

The material was placed in the embankment in horizontal layers not exceeding one foot in thickness, and each layer was carefully compacted before any new material was placed above it.

The inner slope of the dam was protected by a rock riprap one foot thick, extending from the toe to the crest.

The outlet conduit consists of a single line of cast iron pipe thirty inches in diameter, with leaded joints and entirely surrounded by concrete. The concrete has a thickness of eight inches in all directions and is so arranged as to give a horizontal bearing surface four feet wide under the entire length of the pipe. The entire conduit is laid in a trench cut in the shale below the artificial embankment.

Between the inner toe and the axis there are four concrete cut-off walls, eight inches thick and eight feet square, surrounding the conduit at intervals of twenty feet.

The discharge is controlled by a standard gate valve located near the outer toe. At the inner end of the conduit is a balanced valve of the double-beat poppet type, operated from the crest of the dam by means of a steel cable. This is intended for emergency use.

The dam has a freeboard of six feet and a spillway 200 feet wide is constructed near one end of the embankment.

Plans and specifications for the work were prepared by Mr. R. E. Richardson, engineer, of Longmont, Colorado, and approved by the State Engineer on August 3, 1911.

The work was constructed under Mr. Richardson's personal supervision and a State inspector was, therefore, not considered necessary.

Jack Pot, or North Fort Morgan, Reservoir

This reservoir is located in Sections 29, 30, 31 and 32, Township 6 North, Range 58 West, 6th Principal Meridian, in Water District No. 1, Morgan county, Colorado.

It is formed by the construction of an earth dam across the channel of Wildcat creek.

The capacity is 1,770 acre-feet with a depth of water of thirty-one feet above the outlet, and the area of the high-water line is 132 acres.

The dam is 1,830 feet long on the crest and has a maximum height of thirty-six feet. The crest width is fifteen feet and the inside and outside slopes are each 2:1.

A trench, ten feet wide and ten feet deep, is excavated along the entire length of the axis of the dam and filled with carefully puddled material. The material in the embankment was deposited and compacted in layers not exceeding eight inches in thickness.

Across the creek channel a line of sheet piling composed of two thicknesses of two-inch plank, breaking joints, was driven to the underlying shale, the depth varying at different points from four to twenty-three feet.

The inner slope of the embankment is protected by a rock riprap laid on six inches of gravel or broken stone. This riprap is fifteen inches thick for the first ten feet from the bottom and twelve inches thick from there to the top. It abuts against a loose-rock toe-wall, three feet deep and three feet wide. Where the sheet piling is driven this toe-wall is arranged to enclose the top of the sheet piles.

Along the upper edge of the inner slope there is a wooden parapet three and a half feet high. The freeboard is five feet exclusive of the parapet.

The spillway is 400 feet long and is protected by a concrete wall eighteen inches thick by ten feet deep and a concrete apron six inches thick by ten feet wide.

The outlet conduit is a reinforced concrete tube, forty-eight inches inside diameter and twelve inches thick. It is laid in a trench entirely below the artificial embankment and has a horizontal bearing surface four feet wide under its entire length.

There are three concrete cut-off walls, spaced twenty feet apart, surrounding this conduit, each eighteen inches thick and extending three feet in all directions from the outside of the conduit.

The discharge from the reservoir is controlled by a sluice gate at the inner end of the conduit, operated from a wooden bridge communicating with the crest of the dam.

Plans and specifications for the work were prepared by Mr. George T. Prince, engineer, of Denver, and approved by the State Engineer on August 3, 1911.

The work was constructed under Mr. Prince's immediate supervision.

Point of Rocks Reservoir

This reservoir was described in the Fifteenth Biennial Report of the State Engineer but plans and specifications for its construction had not been filed when that report was issued. Subsequently, plans and specifications in accordance with the description contained in the Fifteenth Biennial Report were filed in the State Engineer's office and approved by the State Engineer on August 4, 1911.

The work was completed under the continuous supervision of Mr. Charles E. Shimer, State Inspector, and on October 28, 1911, a final examination was made by Mr. J. W. Johnson, Deputy State Engineer.

The final report of Mr. Johnson and the progress reports of Mr. Shimer showed that the reservoir had been constructed in accordance with the approved plans and specifications and in a satisfactory manner, and that the work was complete with the exception of the emergency gates to be provided at the inner end of the outlet conduit.

Under date November 3, 1911, the State Engineer addressed a letter to the Directors of The North Sterling Irrigation District, formally accepting the reservoir in accordance with the provisions of Section 3205, Revised Statutes of Colorado, 1908.

Silver Lake Reservoir

This reservoir forms a part of the water system of the City of Boulder and is located in Sections 20, 21, 28 and 29, Township 1 North, Range 73 West, 6th Principal Meridian, in Water District No. 6, Boulder county, Colorado.

At this point there is a natural lake on one of the tributaries of North Boulder creek. This natural lake had previously been somewhat enlarged by the construction of a low, rock-filled crib dam. The present plans contemplate its further enlargement by an entirely new dam of the rock-fill type.

The capacity of the lake before enlargement was 807 acre-feet and the total capacity after enlargement will be 2,073 acre-feet, giving the City of Boulder an available storage capacity of 1,266 acre-feet.

The area of the high-water line after enlargement will be eighty-six acres.

The dam has a maximum height of thirty-five feet and is 1,140 feet long on the crest. The crest width is twelve feet, the inside slope is ½:1 and the outside slope 1½:1.

The inside slope is lined with two thicknesses of two-inch plank with tarred felt placed between the two layers. The plank facing at the toe of the slope abuts against and is enclosed by a concrete toe-wall.

The freeboard is five feet and a spillway fifty-five feet wide is arranged at one end of the dam. Provision is made by which the freeboard may be decreased by use of flash boards in the spillway.

The reservoir is located at an altitude of more than 10,000 feet and the drainage area above it is small. Under these circumstances sudden floods are almost unknown and the use of flash boards in the spillway is, therefore, considered safe.

The outlet consists of two lines of thirty-six-inch riveted steel pipe imbedded in concrete in such a way as to make a rectangular mass of concrete nine feet wide by five feet deep, entirely enclosing the pipe. The bottom of this conduit is thirty-seven feet below the crest of the dam.

Concrete cut-off walls twelve inches thick, spaced twenty feet apart, surround this mass of concrete, extending twelve inches from it in all directions.

The inner end of the conduit is surrounded by a reinforced concrete enclosure in which steel gratings are placed to prevent water-logged timber or other rubbish from interfering with the operation of the valves.

The discharge from the reservoir is controlled by sluice gates at the inner end of the conduit, operated by means of valve stems following the slope of the dam to operating stands placed on the crest.

Plans and specifications for this work were prepared by Mr. Fred R. Dungan, City Engineer of Boulder, and were approved by the State Engineer on September 7, 1911.

Work on the construction of this dam has been in progress during the season of 1912 but, owing to the high altitude and severe weather conditions, the dam has not yet been completed. Excavation has shown that it will be necessary to carry the concrete toe-wall to a much greater depth than had been anticipated and this discovery has, also, been the cause of some delay in the work.

During the season of 1912 construction work at Silver Lake and at Albion Lake, which is located near by, and which is also part of the water system of the City of Boulder, has been under the supervision of Mr. J. J. Wilson, State Inspector.

Santa Maria Lake Project

This project forms part of the system of the Rio Grande Reservoir and Ditch Company. It contemplates raising the level of a natural lake known as "Santa Maria lake" about one hundred feet, thereby providing a storage capacity of 40,000 acre-feet.

The reservoir is located in Sections 16, 21, 22, 27 and 28, Township 41 North, Range 2 West, New Mexico Principal Meridian, in Water District No. 20, Mineral county, Colorado.

Santa Maria lake drains into Clear creek which is a tributary of the Rio Grande.

The water supply for the enlarged reservoir is brought from the North Fork of Clear creek through a supply ditch four and a half miles long.

The dam by which this reservoir is formed is an earth embankment 1,265 feet long on the crest, with a maximum height of ninety feet. The crest width is sixteen feet, the inside slope is 3:1 and the outside slope 2:1.

Along the axis of the dam is a puddle trench eight feet wide with a maximum depth of twenty-two feet. This is arranged to make a thorough bond with the puddle core of the embankment.

The dam is under construction by the hydraulic fill process. The work is arranged in such a way as to insure the deposit of the larger rocks and coarse gravel near the faces and no special riprapping is considered necessary.

The outlet is through a tunnel about 600 feet long, with a minimum section six feet wide by seven feet six inches high inside the concrete lining. This tunnel passes under a low portion of the embankment but is about seventy feet below the natural surface at this point.

Near the outer end the tunnel is enlarged to a width of sixteen feet and is closed by two concrete bulkheads twelve feet apart. Through the chamber thus formed pass two forty-eight-inch and one thirty-six-inch cast-iron pipes, each provided with two standard gate valves. These serve to control the discharge from the reservoir. Access to the valve chamber is had through a concrete-lined shaft, six feet square inside, from the surface.

The freeboard is eight feet and a spillway about forty feet wide is cut in the rock near one end of the dam. The sides of the spillway are lined with concrete one foot thick to a height of five feet.

Plans and specifications for this important work were prepared by Mr. T. W. Jaycox, engineer, of Denver, and were approved by the State Engineer, except as to the hydraulic fill process for the construction of the embankment, on September 12, 1911.

The work has been done under the personal supervision of Mr. Jaycox and is now nearly complete.

Bent County Reservoir

This reservoir is located in Sections 19, 20, 29, 30 and 31, Township 25 South, Range 51 West; Section 36, Township 25 South, Range 52 West; Section 6, Township 26 South, Range 51 West, and Section 1, Township 26 South, Range 52 West, 6th Principal Meridian, in Water District No. 67, Bent county, Colorado.

It is formed by the construction of an earth embankment across Rule creek, a tributary of the Arkansas River.

The reservoir has a capacity of 21,733 acre-feet and a high-water area of 1,265 acres with a depth of water of forty-two feet.

The dam is 2,400 feet long on the crest and has an extreme height of seventy-five feet, though, except for a distance of sixty-five feet where it crosses the creek channel, its height does not exceed sixty-two feet.

The embankment is twenty feet wide on the crest. The outside slope is 2:1 for a vertical distance of twenty-two feet below the crest, at which point there is a berme eight feet wide. The slope is then 2½:1 for the next twenty feet. At this point there is another berme eight feet wide, and below this the slope is 3:1. The inside slope is 1:1 above the high-water line, which is ten feet below the crest, and 2:1 below the high-water line. Twenty feet below the high water this inside slope is broken by a berme ten feet wide.

At the inner toe of the embankment a concrete cut-off wall, two feet thick, is constructed and carried to the underlying bed-rock. Where this cut-off wall crosses the creek channel it is made three feet thick. An additional cut-off wall across the creek channel only is constructed on the axis of the dam.

The earth in the embankment is placed in layers not exceeding ten inches in thickness, each layer being sprinkled and rolled to insure thorough consolidation.

The inner slope of the dam is to be protected either by reinforced concrete paving four inches thick, or by a rock riprap twelve inches thick laid on a layer of six inches of broken stone. The choice between these depends upon their relative cost and will be made later. Which ever method of protection is used, the berme, as well as the slopes, will be paved.

The outlet conduit consists of two lines of forty-eight-inch diameter cast iron pipe with leaded joints, laid on bed rock fifty-two feet below the crest of the dam.

Three concrete cut-off walls, one foot thick and extending four feet in every direction from the outside of the pipe, surround this conduit. These walls are spaced forty-five feet apart.

The discharge from the reservoir is controlled by balanced valves of novel and somewhat peculiar construction, placed at the bottom of a concrete valve tower which intersects the inner slope about fifty feet from the toe. In addition to these balanced valves, an ordinary sluice gate is arranged in each conduit for use in emergencies.

The freeboard is ten feet and a spillway fifty-four feet wide is cut in the sandstone bluff at one end of the dam.

Plans and specifications for this work were prepared by Mr. F. T. Lewis, engineer, of La Junta, and were approved by the State Engineer on October 3, 1911.

So far as this office is advised, no construction work has been done up to the date of this report.

Emrich Reservoir

This reservoir is located in Sections 31 and 32, Township 6 North, Range 88 West, 6th Principal Meridian, in Water District No. 57, Routt county, Colorado.

It is formed by the construction of an earth embankment across Emrich gulch, a tributary of Temple creek. which in its turn flows into the Yampa river.

It has a capacity of 242 acre-feet with a depth of water of twenty feet above the bottom of the outlet and a high-water area of thirty-two acres. The drainage area immediately tributary to it is about 800 acres.

The dam is 631 feet long on the crest and has a maximum height of twenty-nine feet. It is ten feet wide on the crest, has an inside slope of 3:1 and an outside slope of 2:1.

The inside slope is protected from the action of the waves by a brush mattress eight inches thick, held in place by woven-wire fencing staked to the embankment.

The earth in the embankment itself is placed in layers not exceeding six inches in thickness, consolidated by the travel of teams and wagons or scrapers used in construction.

The outlet conduit consists of a single line of eight-inch standard cast iron pipe laid on a continuous foundation of concrete four inches thick. The conduit is laid in a trench two feet deep in the natural ground and its bottom is twenty-five feet below the crest of the dam.

A concrete cut-off wall eighteen inches thick by two and one-half feet square, surrounds the pipe at each joint.

The discharge from the reservoir is controlled by a cast iron sluice gate at the inner end of the conduit, operated from the top of a wooden tower.

The freeboard is five feet. At one end of the dam a spillway twenty feet wide and 100 feet long from grade to grade, is arranged.

Plans and specifications for this work were prepared by The Routt County Engineering Company, of Hayden, Colorado, and approved by the State Engineer on October 19, 1911.

This office has not been advised whether the construction has been completed.

Hallett and Osbin Reservoir

This reservoir is located in Section 3, Township 36 North, Range 13 West, New Mexico Principal Meridian, in Water District No. 34, Montezuma county, Colorado.

It receives its water from Crystal creek, a tributary of the Rio Mancos, through an inlet ditch known as "The Crystal Creek Water Company's ditch."

It has a capacity of forty-one acre-feet with a depth of water of twenty feet above the outlet and a high-water area of eight acres.

The dam is of earth, with a maximum height of twenty-four feet, and is 325 feet long on the crest. The crest width is six feet, the inside slope is 3:1 and the outside slope is 2:1. A puddle core extends from an impervious stratum below the surface to the top of the dam. This puddle core is eleven feet thick at the bottom, three feet thick at the top and has a maximum height of approximately forty feet.

The material is placed in the embankment itself in irregular layers from six to fifteen inches in thickness, consolidated by the travel of teams and wheeled scrapers.

The inner slope of the embankment is protected by a rock riprap.

The outlet conduit consists of a single line of six-inch standard cast iron pipe with leaded joints, laid at an elevation twenty-four feet below the crest of the dam.

Two concrete cut-off walls, each three feet thick by four and a half feet square and spaced fifty feet apart, surround this pipe. Both the inner and outer ends of the pipe are also imbedded in heavy masses of concrete.

The discharge from the reservoir is controlled by a standard gate valve at the lower end of the conduit.

The freeboard is four feet. A spillway twenty feet wide and about 270 feet long from grade to grade is constructed through a rocky hill at one end of the dam.

Plans and specifications for this work were prepared by Mr. E. C. Cline, surveyor, of Mancos, Colorado, and were approved by the State Engineer on October 26, 1911.

This office has not been advised of the completion of the work.

Weber Reservoir

This reservoir is located in Sections 1 and 12, Township 36 North, Range 13 West, New Mexico Principal Meridian, in Water District No. 34, Montezuma county, Colorado.

It has a capacity of 442 acre-feet with a depth of water of twenty feet above the bottom of the outlet and a high-water area of forty-four acres.

It receives its water supply from the Middle Fork of the Rio Mancos through an inlet ditch about two and a half miles long.

The main dam of this reservoir is an earth embankment 1,100 feet long on the crest, and with a maximum height of thirty feet. The crest width is ten feet, the inside slope 3:1 and the outside slope 2:1. The inner slope is paved with flat stones six inches thick.

The embankment is built up in irregular layers of six to fifteen inches thickness consolidated by the travel of teams and wheeled scrapers used in the construction.

The dam has a puddle core extending from an impervious substratum to the crest of the dam. This core has a maximum height of about fifty feet, is eleven feet thick at the bottom and three feet thick at the top.

In addition to the main dam there is a dyke protecting a low place in the rim of the reservoir. The length of this dyke is 924 feet and its maximum height ten feet. Its proportions and method of construction are the same as those of the main dam except that its width on the crest is only six feet instead of ten.

The outlet conduit consists of a single line of eighteen-inch standard cast iron pipe with leaded joints, laid at an elevation twenty-five feet below the crest of the dam. This pipe is entirely surrounded by a layer of concrete six inches thick.

Two concrete cut-off walls, each two feet thick by six feet square and spaced twenty feet apart, surround this conduit.

The outlet pipe is eighty feet long and is provided with concrete head-walls at both ends, each three feet thick, eight feet wide and seven feet high.

The conduit does not pass under the main dam but passes under the dyke at a point where the latter is seven feet high. It is laid in a trench about twenty feet deep, which trench was filled with material carefully puddled in place after the construction of the conduit.

The water finds its way to the outlet conduit through an open cut several hundred feet long. At the inner end of the outlet conduit there is a steel sluice gate operated from the top of a wooden tower, and by means of this the discharge from the reservoir is controlled.

The freeboard is five feet and a spillway thirty feet wide is excavated through the hill at one end of the main dam.

Plans and specifications for this work were prepared by Mr. E. C. Cline, surveyor, of Mancos, Colorado, and were approved by the State Engineer on October 26, 1911.

The State Engineer has not been advised of the completion of the work.

Continental Reservoir

This reservoir is located in Sections 20, 21, 29, 30 and 31, Township 42 North, Range 3 West, New Mexico Principal Meridian, in Water District No. 20, Hinsdale county, Colorado.

It is formed by the construction of an earth dam across Clear creek, a tributary of the Rio Grande.

Its capacity is 38,838 acre-feet with a depth of water of eighty-five feet above the bottom of the outlet, and the area of its high-water line is 835 acres.

The dam has a maximum height of 100 feet and is 360 feet long on the crest. The crest width is thirty feet, the inside slope 3:1 and the outside slope 2:1.

Along the axis of the dam a cut-off trench is excavated to the underlying bed rock. This trench is six feet wide on the bottom and not less than ten feet at the surface of the ground. It is filled with puddled material, or material sluieed in by the hydraulic process.

The embankment itself is constructed by first depositing dry earth in longitudinal dykes along the inner and outer toes of the finished structure. The material is piped or sluiced from the inner faces of these dykes to form the interior of the main structure.

The dykes originally deposited are twenty feet high and after material has been sluiced from them to the interior of the dam, new dry earth dykes are built up along the faces of the dam to an additional height of twenty feet, and the sluicing process repeated.

By this means it is hoped to gain all the advantages of compactness claimed for the hydraulic fill process, without the weaknesses and disadvantages attendant upon the use of an excessive quantity of water.

The inner face of the embankment is protected by a rock riprap eighteen inches thick. This riprap rests on a four-inch layer of screened gravel and abuts at the bottom against a mass of loose rock filling a trench two feet wide by three feet deep.

The outlet conduit is a concrete-lined tunnel with a minimum section six feet wide by seven feet six inches high inside the lining. This tunnel is driven through the ground underneath the embankment and has a cover of forty feet of natural earth and rock above it.

Immediately under the crest of the dam the tunnel is widened to thirteen feet three inches clear width and is closed by two concrete bulkheads eleven feet six inches apart, thus forming a valve chamber which is reached through a concrete-lined shaft, six feet square, from the crest of the dam.

Through this valve chamber pass three lines of thirty-six-inch steel pipe, and in each pipe are placed two standard gate valves. By means of these the discharge of water from the reservoir is controlled.

The freeboard is ten feet and a spillway 100 feet wide on the bottom is excavated in the hill at one end of the dam. The side slopes of the spillway cut are 1:1, and these slopes, as well as the bottom of the spillway, are paved with rock for a length of 200 feet.

Plans and specifications for this work were prepared by Mr. T. W. Jaycox, engineer, of Denver, and were approved by the State Engineer on October 31, 1911.

So far as this office is advised, construction work has not yet begun.

Big Park Reservoir No. 4

This reservoir is located in Sections 14 and 15, Township 12 South, Range 102 West, 6th Principal Meridian, in Water District No. 42, Mesa county, Colorado.

It derives its water supply through a feeder ditch from "Pipe Line wash," a tributary of the Little Dolores river.

It has a capacity of 1,585 acre-feet with a depth of water of twenty-two feet above the bottom of the outlet and a high-water area of 149 acres.

The dam is an earth embankment with a maximum height of twenty-seven feet and a length on the crest of 1,880 feet.

A cut-off trench is excavated to bed-rock along the axis of the dam and filled with selected material. The embankment is twelve feet wide on the crest, has an inside slope of $2\frac{1}{2}$:1 and an outside slope of 2:1.

It is built in layers not exceeding one foot in thickness, consolidated by the travel of teams and scrapers. The inner slope is protected by a rock riprap ten inches thick.

The outlet conduit consists of a single line of twenty-inch sheet steel pipe with slip joints. This pipe line is laid on a concrete foundation in a trench cut in the natural earth. At each joint the pipe is surrounded by a concrete collar eight inches thick and projecting eighteen inches in every direction from the outside of the pipe.

The discharge from the reservoir is controlled by a standard gate valve located near the outer toe of the embankment. An additional gate valve is placed near the inner toe and operated by a stem extending to the surface of the water through a twelve-inch steel pipe. This is intended for use in emergencies only.

The freeboard is five feet. The spillway is a natural depression located at the opposite end of the reservoir about half a mile from the dam.

Plans and specifications for this work were prepared by Mr. Frank R. Hall, engineer, and approved by the State Engineer on November 14, 1911.

Lovella Reservoir

This reservoir is located in Sections 29, 30, 31 and 32, Township 12 North, Range 61 West, 6th Principal Meridian, in Water District No. 1, Weld county, Colorado.

It has a capacity of 5,705 acre-feet with a depth of water of 25.3 feet above the bottom of the outlet. The high-water area is 500 acres.

It derives its supply of water from Crow creek through an inlet ditch about seven miles long.

The reservoir is a natural basin the capacity of which is increased by a long, low earth dam.

The dam has a length on the crest of 6,781 feet and a maximum height of 19.4 feet. The height of the crest of the dam above the bottom of the outlet is 30.6 feet. The width of the embankment on the crest is ten feet, the inside slope is $1\frac{1}{2}$:1 and the outside slope 2:1.

The material is placed in the embankment in layers not exceeding one foot in thickness and consolidated by the travel of teams and wagon wheels.

The inner slope is protected by a reinforced concrete facing six inches thick, which abuts against a toe-wall one foot thick and three feet deep at the foot of the slope. This facing is finished at the top by a parapet wall eight inches thick and three feet high on the face. The crest of the parapet wall is 1.5 feet above the top of the embankment. The parapet wall, facing, and toe-wall are reinforced with No. 10 gauge three-inch mesh expanded metal.

The outlet conduit is a reinforced concrete tube laid in a trench about twelve feet deep in the natural earth. The conduit is seventy feet long and has an inside diameter of forty-two inches. The walls are six inches thick and are reinforced with No. 10 three-inch mesh expanded metal.

Two cut-off walls, each six inches thick by nine feet square, are spaced about twenty-three feet apart and about an equal distance from the ends of the conduit.

The discharge from the reservoir is controlled by a sluice gate at the inner end of the conduit, operated from the top of a steel tower which is connected with and forms a part of a steel foot bridge extending to the crest of the dam.

It is intended to maintain a freeboard of five feet, measured from the top of the parapet wall. However, no spillway has been provided since the reservoir supply is under perfect control at the headgates of the inlet ditch.

Plans and specifications for this work were prepared by Mr. A. G. Lincoln, engineer, of Greeley, and approved by the State Engineer on December 19, 1911.

The State Engineer's office has not been advised of the completion of the reservoir.

Spring Park Reservoir

This reservoir is located in Sections 11, 14, 15, 22 and 23, Township 7 South, Range 87 West, 6th Principal Meridian, in Water District No. 38, Eagle county, Colorado.

It has a capacity of 2,522 acre-feet with a depth of water of nineteen feet above the bottom of the outlet. The high-water area is 295 acres.

It receives its supply from Cattle creek, a tributary of the Roaring Fork, through an inlet ditch about 2.5 miles long.

The dam is of earth, with a maximum height of twenty-five feet and a length on the crest of 1,645 feet. The embankment is twelve feet wide on the crest, has an outside slope of 1½:1 and an inside slope of 3:1.

The earth is deposited in layers not exceeding one foot in thickness, consolidated by the travel of teams, wagons and scrapers.

No provision is made for a puddle trench or cut-off wall to prevent possible seepage under the embankment.

The inner face of the dam is protected by a rock riprap eight inches thick, laid on a four-inch layer of small stones not exceeding 2.5 inches in any dimension. This riprap abuts against a toe-wall of loose rock placed in a trench two feet wide and two feet deep at the foot of the slope.

The outlet conduit is a reinforced concrete pipe with an inside diameter of three feet. The walls of this pipe are eight inches thick, except at the bottom where the thickness is twelve inches and where the circular form is departed from so as to give a horizontal bearing surface three feet wide.

The conduit is reinforced with twisted square steel bars spaced six inches in both directions. There are two sets of these bars, one placed near the inside and one near the outside surface.

The conduit is surrounded by concrete cut-off walls, each one foot thick, extending two feet in all directions from the outside of the conduit and spaced twenty-five feet apart.

The discharge from the reservoir is controlled by a cast iron sluice gate placed at the inner end of the conduit in a concrete valve well. This valve well is reached by a car suspended from a cable connecting the top of the valve tower with the crest of the dam.

It is intended to maintain a freeboard of six feet, but no spillway has been provided since the supply to the reservoir may be controlled at the headgate of the inlet ditch.

Plans and specifications for this work were prepared by Mr. Glen A. Izett, engineer, of Denver, and were approved by the State Engineer on December 26, 1911.

The work of construction was completed in July, 1912.

Red Top Reservoir

This reservoir is located in Section 14, Township 24 South, Range 61 West, 6th Principal Meridian, in Water District No. 17, Pueblo county, Colorado.

It derives its water supply from Mustang creek, a tributary of the Apishapa river, through an inlet ditch about four miles long.

The dam, which is of earth, has been constructed for a number of years to a height of eighteen feet. It is intended to construct it eventually to a height of twenty-five feet.

At the present time the reservoir capacity is about 600 acre-feet. When completed, the capacity will be in the neighborhood of 2,000 acre-feet.

The present plans and specifications provide for a new outlet conduit and control gates. The new conduit is a reinforced concrete structure eleven feet eight inches wide by four feet four inches high, containing three square tubes, each three by three feet. The concrete walls are eight inches thick and are reinforced in both directions with one-half-inch twisted square steel bars. The transverse bars are spaced six inches apart. The longitudinal bars are spaced one foot nine inches apart.

The inlet end of the conduit is provided with a head-wall two feet six inches thick, twenty-two feet wide and about fifteen feet high. Twenty-five feet from the head-wall is a cut-off wall one foot thick and extending three feet from the outside of the conduit in all directions.

The discharge is controlled by cast iron gates placed in a wet well forty-five feet from the inner end of the conduit, and operated from the top of a concrete tower constructed at this point. The entire outlet structure is about 200 feet long.

Plans and specifications for this work were prepared by Mr. A. A. Weiland, engineer, of Pueblo, and approved by the State Engineer on January 4, 1912.

The State Engineer's office has not been advised of the completion of the work.

San Luis Valley Reservoir

This reservoir is located in Sections 27 and 34, Township 39 North, Range 3 East, New Mexico Principal Meridian, in Water District No. 20, Rio Grande county, Colorado.

It has a capacity of about 4,000 acre-feet with a depth of water of eighty-one feet above the bottom of the outlet and a high-water area of about 100 acres.

It is formed by the construction of a rock-fill dam across Beaver creek, a tributary of the South Fork of the Rio Grande.

The dam has a maximum height of about eighty-five feet and a length on the crest of 190 feet. The crest width is fifteen feet, the inside slope is $\frac{1}{2}:1$ and the outside slope $1\frac{1}{2}:1$.

The dam is built on a rock foundation from which all earth and organic matter are removed.

On the up-stream face of the dam a thickness of five feet of the rock fill is hand laid dry rubble. Between this and the center line of the dam the fill consists of the largest obtainable rock set in place by a derrick. The portion of the fill between the center line and the lower face is loose rock dumped into place.

No rock of less than four inches in least dimension is permitted in any portion of the fill, and not more than twenty-five per cent is permitted to be less than six inches in least dimension. No earth is permitted in any portion of the fill.

The inner face of the dam is protected by a reinforced concrete paving. This paving is twenty-four inches thick from the toe of the slope to an elevation thirty-one feet above the bottom of the outlet. For the next forty feet in height it is eighteen inches thick and for the remainder of the height of the dam it is twelve inches.

This paving is reinforced with two layers of triangular mesh reinforcing, Style No. 23, weighing seventy-two pounds per 100 square feet. One layer is placed near the inner face and one near the outer face of the paving.

The outlet conduit is a reinforced concrete tunnel four feet six inches wide by five feet high. This is constructed near one end of the dam.

The discharge from the reservoir is controlled by a cast iron sluice gate placed at the inner end of this conduit, and operated from the top of a concrete valve tower connected by a bridge with the crest of the dam. A second sluice gate is placed on the outside of this valve tower so that the well may be drained if desired, and rendered accessible for inspection or repairs.

All concrete used in the facing of the dam or in the construction of the valve tower is water-proofed by the admixture of the patented compound known as "Ceresit."

The freeboard is five feet and a spillway 180 feet wide is excavated in the rock around one end of the dam.

Plans and specifications for this work were prepared by Mr. G. N. Houston, engineer, of Denver, and were approved by the State Engineer on January 23, 1912. Some minor modifications were subsequently proposed and were approved by the State Engineer on November 4, 1912.

Construction work has recently begun and is under the immediate supervision of Mr. Houston.

Little Dolores Reservoir

This reservoir is located in Section 19, Township 12 South, Range 102 West, and in Sections 13 and 24, Township 12 South, Range 103 West, 6th Principal Meridian, in Water District No. 42, Mesa county, Colorado.

It has a capacity of 4,895 acre-feet with a depth of water of thirty-five feet above the bottom of the outlet and a high-water area of 308 acres.

It receives its water supply from the Little Dolores river, a tributary of the Grand river, through an intake ditch about 2.5 miles long.

The dam is of earth, with a maximum height of forty feet and a length on the crest of about 1,500 feet. The embankment is twelve feet wide on the crest, has an inside slope of $2:1$ and an outside slope of $2\frac{1}{2}:1$.

It is constructed by placing the earth in layers not more than one foot in thickness, each layer being consolidated by the travel of teams and scrapers.

At the inner toe of the embankment is a cut-off trench five feet wide on the bottom and extending to an impervious substratum. This trench is filled with selected material carefully puddled in place.

The inner face of the embankment is constructed also of selected material which is carefully bonded with that placed in the cut-off trench at the toe.

The inner slope is protected by a rock riprap, or by a reinforced concrete pavement as may be determined later.

The outlet conduit is of reinforced concrete, two feet wide by three feet high inside. The base is twelve inches thick by four and a half feet wide, and the arch and side walls are nine inches thick. They are reinforced in longitudinal direction by three-quarter-inch steel bars, spaced six inches apart, and transversely by one-half-inch steel bars similarly spaced.

The conduit is surrounded by four concrete cut-off walls one foot thick by seven feet square, spaced twenty-four feet apart.

Thirty-eight feet from the inner toe of the embankment is a concrete valve tower, three feet six inches square inside by forty-five feet high above the bottom of the foundation. Through the bottom of this valve tower passes a thirty-inch riveted steel pipe in which is placed a standard gate valve.

An open concrete conduit forms the communication between the inlet end of this steel pipe and the body of the reservoir. The valve well is thus kept dry and access to the valve is possible at all times.

The freeboard is five feet and a spillway is provided, with its bottom five feet below the crest of the dam, thus making it impossible to raise the water level above the established high-water line.

Plans and specifications for this work were prepared by Messrs. J. E. Youngquist and J. B. Claybaugh engineers, of Fort Morgan, and were approved by the State Engineer on February 15, 1912.

The State Engineer's office has not been advised of the commencement of the work on this reservoir.

Gilbertson Reservoir

This reservoir is located in Section 9, Township 1 South, Range 56 West, 6th Principal Meridian, in Water District No. 1, Washington county, Colorado.

It has a capacity of 491 acre-feet with a depth of water of fifteen feet above the bottom of the outlet and a high-water area of sixty-six acres.

It is formed by the construction of an earth dam across Ketchum draw, a tributary of Beaver creek, which in turn flows into the South Platte river.

The dam has a maximum height of twenty-three feet and is about 1,250 feet long on the crest. The embankment is ten feet wide on the crest and has an inside slope of 4:1 and an outside slope of 2:1.

The embankment is constructed by placing the earth in layers not exceeding one foot in thickness, each layer being consolidated by the travel of teams and scrapers.

At the inner toe of the embankment there is a cut-off trench four feet wide on the bottom and carried to an impervious substratum. This trench is filled with selected material, carefully puddled in place, and the use of this selected material is continued up the inside face of the embankment. On account of the flat inside slope, it is not believed that riprap or other embankment protection will be necessary.

The outlet conduit consists of a single line of No. 10 gauge riveted steel pipe twenty inches in diameter, entirely surrounded by a layer of concrete four inches thick except on the bottom, where the thickness is six inches and the width is extended to make a horizontal bearing surface two feet four inches wide.

This conduit is surrounded by two concrete cut-off walls, each nine inches thick by six feet six inches square. One of these is placed twelve feet from the inner end of the conduit and the second one twelve feet farther toward the center of the dam.

In addition to these cut-off walls there is a concrete head-wall twelve inches thick by about ten feet square, at each end of the conduit.

Thirty-nine feet from the inner end of the conduit is the valve tower. This tower rests on a concrete foundation three feet thick by six feet square, and is itself built of concrete with walls thirteen inches thick to a height of seven feet. The remaining portion of the valve tower consists of a No. 10 gauge riveted steel pipe twenty-four inches in diameter, extending up to the level of the crest of the dam.

At the bottom of this tower is placed a sluice gate by means of which the discharge from the reservoir is controlled. The valve well is wet and the sluice gate is inaccessible at all times except when the reservoir is empty.

The outlet conduit is constructed in a trench in the natural ground, its bottom being twenty feet below the crest of the dam.

The freeboard is five feet and a spillway is excavated to that depth below the crest of the embankment.

Plans and specifications for this work were prepared by Mr. J. E. Youngquist, engineer, of Fort Morgan, and were approved by the State Engineer on February 15, 1912.

The State Engineer's office has not been advised of the completion of this work.

Denver Union Water Company's Diversion Dam

This dam does not form part of a storage reservoir but, since it is more than ten feet in vertical height, it comes within the provisions of the law requiring submission to and approval by the State Engineer.

The dam is located very near the line between Sections 8 and 9, Township 7 South, Range 69 West, 6th Principal Meridian, in Water District No. 8, Jefferson county, Colorado.

It is a concrete over-fall dam of ogee section, constructed across the South Platte river, and forming part of the intake structure by which water is diverted into a pipe line to be conveyed to filter beds a few miles below, and thence to the City of Denver as a part of its domestic supply.

The over-fall portion of the dam is sixty feet long on the crest and the extreme height from the bottom of the foundation to the crest is twenty-six feet, the height above the bottom of the river being about fifteen feet. The base of the dam is twenty-eight feet wide.

At each end of the over-fall are two sluice ways closed by cast iron gates, each opening being four feet wide by five feet high.

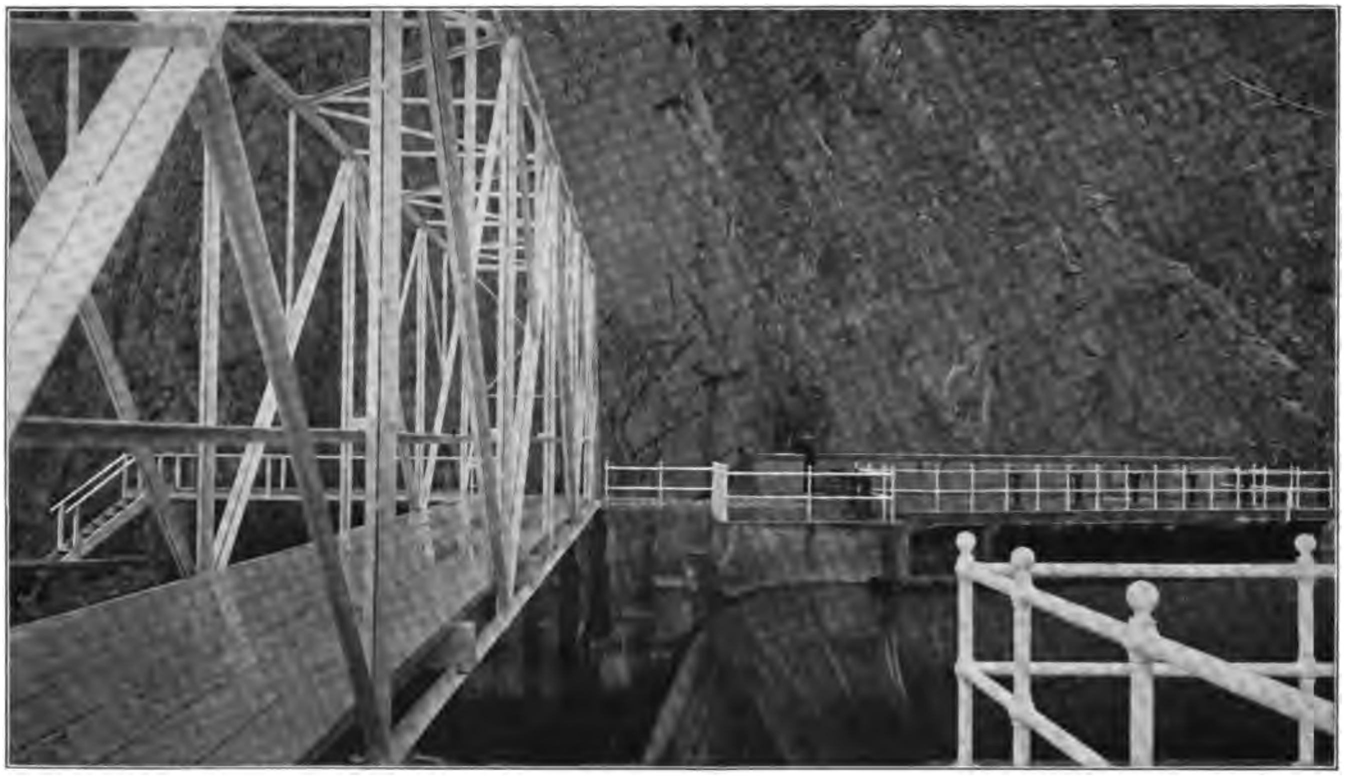
The entire length of the structure between faces of abutment walls is ninety feet.

On the right-hand bank of the river is an intake chamber constructed of concrete in an opening excavated in solid rock. Water flows into this intake chamber through five openings, each three feet square, and each closed by a cast iron sluice gate. The bottom of these openings is nine feet above the bottom of the sluice ways through the dam.

From the intake chamber the water flows through a rock tunnel six feet square.

The entire structure is of concrete and steel and is built in the most substantial manner.

SETTLING BASIN.
Intake of Denver Union Water Company's pipe line in Platte Canon.
D. G. Thomas, Chief Engineer The Denver Union Water Company.



DIVERSION DAM.
Intake of The Denver Union Water Company's Pipe Line in Platte Canon.
D. G. Thomas, Chief Engineer The Denver Union Water Company.

Plans and specifications for the work were prepared by Mr. D. G. Thomas, Chief Engineer The Denver Union Water Company, and were approved by the State Engineer on April 13, 1912. The entire work was executed under the immediate supervision of Mr. Thomas.

On October 12, 1912, the State Engineer visited and examined the completed work in company with Mr. Thomas, and subsequently addressed to The Denver Union Water Company a letter of formal acceptance and approval, in accordance with the provisions of Section 3205, Revised Statutes of Colorado, 1908.

Two Buttes Reservoir

This structure was described on pages 125 and 126 of the Fifteenth Biennial Report of this office. The greater part of the work was completed in 1911, but it was found that the concrete slope pavement originally designed and partly constructed was not entirely satisfactory.

It was, therefore, proposed to substitute rock riprap on that portion of the face still unprotected, and plans and specifications covering this change were prepared.

This rock riprap is eighteen inches thick, of which the lower four to six inches consists of spalls. The remainder consists of hand laid rock, of which no stone weighs less than 100 pounds.

At the foot of the slope, or at the top of the concrete paving previously laid, a trench two feet wide by 2.5 feet deep is excavated and filled with large rock. Against this wall the riprap abuts.

At the crest of the dam the riprap finishes in a parapet wall three feet high by eighteen inches thick. This wall rests on a foundation two feet deep and two feet wide. The wall and its foundation are composed of dry rubble.

Plans and specifications for this work were prepared by Field, Fellows & Hinderlider, engineers, of Denver, and were approved by the State Engineer on May 22, 1912.

The work is reported to be nearly complete at this time.

Lone Cone Reservoir

This reservoir is located in Section 12, Township 43 North, Range 13 West, New Mexico Principal Meridian, in Water District No. 60, San Miguel county, Colorado.

A small reservoir, with an earth dam about eighteen feet high, has been in existence here for a number of years. The purpose of the new work is to raise the dam and increase the capacity of the reservoir.

The reservoir as enlarged has a capacity of 1,664 acre-feet with a depth of water of twenty-two feet above the bottom of the outlet and a high-water area of 177 acres.

It receives its water supply from Naturita creek through a feeder known as the "Lone Cone ditch."

The enlarged dam is of earth, has a maximum height of twenty-seven feet and a length on the crest of 2,900 feet.

It has a width on the crest of ten feet, an inside slope of 3:1 and an outside slope of 2:1 for a vertical distance of twelve feet below the crest, where there is a berme six feet wide. Below this the outside slope is 2½:1.

The new work is so located that the old embankment forms the inner toe of the enlarged dam.

The outer slope of the old dam was cut into terraces parallel to the axis of the dam, and with vertical faces 3.5 feet high.

The earth in the new work is placed in layers not exceeding eight inches in thickness, moistened and consolidated by the travel of teams.

Where the new embankment rests on the natural earth a cut-off trench six feet wide by three feet deep is excavated and filled with selected material carefully puddled in place.

No provision is made for the protection of the inner slope by riprapping or paving.

The old outlet consisted of a heavy wooden tube eighteen inches square inside, laid in pitch or coal tar. The new outlet consists of a line of twenty-inch standard cast iron pipe laid in a tunnel 100 feet long excavated in the rock at the extreme northern end of the dam. This tunnel is six feet high inside and its inner end is closed by a solid concrete bulkhead eight feet thick.

Through this bulkhead the cast iron pipe passes. The inner end of this pipe is closed by a cast iron sluice gate operated from a platform above the water line.

The joints in the pipe are calked with oakum and leaded. The pipe is covered to a depth of one foot by a back filling of loose rock.

The upper half of the tunnel is left open and by removing the loose rock access may be had to the entire length of the outlet pipe at any time.

The ends of this tunnel communicate with the reservoir at one end and the creek channel at the other through open cuts four feet wide on the bottom and each about 250 feet long.

The freeboard is 5.40 feet. A spillway 100 feet wide is excavated around the southern end of the dam.

Plans and specifications for this work were prepared by Mr. A. M. Browning, engineer, of Norwood, Colorado, and approved by the State Engineer on May 23, 1912.

The engineer in charge, Mr. Browning, has just reported to this office that the reservoir has been completed in accordance with the approved plans and specifications.

Mountain View No. 1 Reservoir

This reservoir is located in Sections 11 and 14, Township 21 South, Range 69 West, 6th Principal Meridian, in Water District No. 12, Custer county, Colorado.

It has a capacity of 9,873 acre-feet with a depth of water of 113 feet above the bottom of the outlet and a high-water area of 199 acres.

It receives its supply from Hardscrabble creek, a tributary of the Arkansas river, through an inlet canal a little more than a mile long.

The main dam is an earth embankment having a maximum height of 120 feet and a length on the crest of 3,000 feet. In addition to this there is a small earth dam eighteen feet high by 390 feet long on the crest at a low place in the rim of the reservoir.

Both dams have crest widths of fifteen feet, inside slopes 2:1 and outside slopes 3:1.

Along the inner toe of the embankment is driven a line of sheet piling of 2"x10" Oregon fir, provided with cast iron shoes. This sheet piling is driven to bed rock.

Where the embankment is more than twenty feet high a concrete wall one foot thick by two feet deep is built against the sheet piling, and the riprap abuts against this wall. Where the embankment is less than twenty feet high this concrete wall is omitted.

The inner slope of the dam is protected by a rock riprap eighteen inches thick. The lower six inches of this riprap consists of gravel or broken stone, and the upper twelve inches of hand laid paving in which no stone weighing less than 100 pounds is placed.

The embankment is built up in horizontal layers not exceeding eight inches in thickness, moistened and compacted by corrugated rollers.

The outlet conduit consists of a single line of standard cast iron pipe thirty-six inches in diameter, with leaded joints. This pipe is entirely surrounded by concrete of which the outside dimensions are four feet by four feet.

At intervals of twenty feet the conduit is surrounded by concrete cut-off walls eight inches thick by seven feet square.

The discharge from the reservoir is controlled by a standard gate valve near the outlet end. In addition to this a balanced valve of the double-beat poppet type is placed at the inner end and arranged to be operated by a cable extending to the crest of the dam or by a hydraulic system of control. This permits inspection and repair of the conduit in case of emergencies.

The freeboard is seven feet. Near one end of the main dam a spillway 100 feet wide and about 200 feet long from grade to grade is excavated.

This spillway has concrete side walls seven feet high by eighteen inches thick at the top and is provided with a concrete pavement six inches thick.

This reservoir is the property of the Hardscrabble Irrigation District.

Plans and specifications for the work were prepared by Mr. A. B. McFall, engineer, of Florence, Colorado, and were approved by the State Engineer on July 23, 1912.

The State Engineer's office has not been advised of the commencement of construction work.

Antelope Reservoir

This reservoir is located in Section 31, Township 8 North, Range 92 West; Section 6, Township 7 North, Range 92 West, and Section 1, Township 7 North, Range 93 West, 6th Principal Meridian, in Water District No. 44, Moffat county, Colorado.

It is formed by the construction of an earth dam across the North Fork of Big gulch, which forms a part of the Yampa river drainage.

The reservoir has a capacity of 302 acre-feet with a depth of water of twenty-four feet above the bottom of the outlet and a high-water area of twenty-nine acres.

The dam has a maximum height of thirty-four feet and is 423 feet long on the crest. The crest width is ten feet. Both up-stream and down-stream slopes are 1¾:1 for a distance of seventeen feet below the crest, and 2:1 from there to the toe.

Across the bed of the creek on the center line of the dam is excavated a cut-off trench six feet wide on the bottom by ten feet deep. This trench is filled with selected material puddled in place.

The embankment is built in layers not exceeding twelve inches in thickness, consolidated by the travel of teams and scrapers.

No provision is made for riprap unless it is found by experience to be necessary in this case.

The outlet conduit is placed in a trench in the natural ground at an elevation twenty-nine feet below the crest of the dam. It consists of a twelve-inch riveted pipe, built of No. 16 gauge sheet steel, and provided with concrete head-walls at both ends.

The pipe is entirely surrounded by concrete four inches thick from the inner end to the center line of the dam. At the inner end of the pipe is placed a standard gate valve operated from a wooden bridge communicating with the crest of the dam.

The freeboard is five feet and a spillway twenty-five feet wide is excavated around one end of the dam.

Plans and specifications for the work were prepared by Mr. Joseph Biskup, engineer, of Craig, Colorado, and were approved by the State Engineer on October 4, 1912.

The State Engineer's office has not been advised of the completion of the work.

Hopkins Reservoir

This reservoir is located on unsurveyed land near the center of Township 6 South, Range 88 West, 6th Principal Meridian, in Water District No. 38, Garfield county, Colorado.

It derives its water supply from springs which drain directly into the reservoir.

It has a capacity of forty-seven acre-feet with a depth of water of fifteen feet above the bottom of the outlet and a high water area of eleven acres.

It is formed by the construction of an earth dam having a maximum height of twenty-three feet and a length on the crest of 425 feet. The crest width is ten feet, the outside slope is 2:1 and the inside slope 3:1.

The material in the embankment is placed in layers and rolled.

The outlet conduit is a single line of ten-inch vitrified pipe. Each joint is surrounded by a mass of concrete two feet long by two feet six inches in diameter.

At the inner end of the conduit is an eight-foot length of steel pipe to which is secured a standard gate valve. The bottom of this conduit is twenty feet below the crest of the dam.

There is no provision for protection of the inside slope.

The freeboard is five feet and a spillway fifteen feet wide is excavated around one end of the dam.

Plans and specifications for the work were prepared by Mr. Karl Rosenberg, engineer, of Glenwood Springs, and were approved by the State Engineer on October 15, 1912.

The State Engineer's Office has not been advised of the completion of the work.

Nile Irrigation District Reservoirs

There are three of these reservoirs, differing only in dimensions and in such minor details as depend upon the sites. These are the Macarthy, the Adams and the West Nile.

Macarthy Reservoir: The Macarthy reservoir is located in Sections 22, 23, 26, 27 and 34, Township 3 North, Range 60 West, in Water District No. 1, Morgan county, Colorado.

It has a capacity of about 6,700 acre-feet with a depth of water of twenty-four feet above the bottom of the outlet and a high-water area of about 500 acres.

It receives its water supply from Antelope creek through an inlet ditch about 4.5 miles long.

There are two earth dams which form the Macarthy reservoir, their aggregate length on the crest being 7,532 feet. The maximum height of the main dam is twenty-eight feet. The embankment is fifteen feet wide on the crest, with outside slope 2:1 and inside slope 3:1.

The inner slope is protected by a concrete pavement.

The outlet is a rectangular reinforced concrete tube, three feet six inches square inside, with side walls and bottom eight inches thick and top twelve inches thick.

There are four concrete cut-off walls between the inner toe and the axis of the dam, each one foot thick by eleven feet square. These walls are spaced twenty feet apart.

The entire length of the outlet conduit is 145 feet.

The discharge from the reservoir is controlled by a sluice gate at the inner end of the conduit, operated from the top of a tower connected by a bridge with the crest of the dam.

The freeboard is six feet and a spillway 150 feet wide is constructed around one end of the dam.

Adams Reservoir: The Adams reservoir is located in Sections 9, 10, 15, 16, 21 and 22, Township 1 South, Range 60 West, 6th Principal Meridian, in Water District No. 1, Adams county, Colorado.

It receives its water supply from Bijou creek through an inlet ditch about 2.5 miles long.

It has a capacity of 5,444 acre-feet with a depth of water of twenty-three feet above the bottom of the outlet and a high-water area of 448 acres.

There are eight earth dams aggregating 13,818 feet long on the crest. The maximum height is twenty-three feet. The cross-section of the embankment and the slope protection are the same as for the Macarthy reservoir.

The bottom of the outlet is twenty-nine feet below the crest of the dam.

The outlet conduit consists of a double rectangular tube, each opening of which is five feet wide by five feet three inches high. The outside dimensions of the structure are seven feet two inches in height by twelve feet two inches in width.

Between the inner toe and the axis of the dam are four concrete cut-off walls, each fifteen inches thick, and extending two feet below and on each side of the conduit, and three feet above. These cut-off walls are spaced twenty feet apart.

The discharge from the reservoir is controlled by sluice gates placed and operated as in the Macarthy reservoir. The entire length of the conduit is 143 feet.

The freeboard is six feet and a spillway 200 feet wide is provided.

West Nile Reservoir: The West Nile reservoir is located in Sections 7 and 18, Township 2 North, Range 60 West, and Sections 12 and 13, Township 2 North, Range 61 West, 6th Principal Meridian, in Water District No. 1, Weld and Morgan counties, Colorado.

It is formed by the construction of an earth dam across Rock creek, a tributary of Kiowa creek, which in turn flows into the South Platte river.

Its capacity is approximately 2,200 acre-feet and its high-water area about 400 acres.

There are two earth dams aggregating 6,200 feet in length on the crest. The extreme height is thirty-seven feet. The embankment and riprap dimensions and construction are the same as for the Macarthy reservoir.

Where the dam crosses Rock creek a cut-off trench is excavated to an impervious substratum and filled with selected material.

The outlet conduit is twenty feet below the crest. Its construction and dimensions are exactly the same as for the Macarthy reservoir except that the length of the conduit is only eighty-four feet.

The freeboard is six feet and a spillway 150 feet wide is provided.

Plans and specifications for all of these reservoirs were prepared by Mr. Frank H. Adams, engineer, of Denver, and were approved by the State Engineer on October 30, 1912.

The State Engineer's office has not been advised of the completion of the work.

Manitou Reservoir

This reservoir forms part of the domestic water system of the Town of Manitou, and is located in Section 33, Township 13 South, Range 68 West, 6th Principal Meridian, in Water District No. 10, El Paso county, Colorado.

It is formed by the construction of a concrete dam across the north branch of French creek, which is a tributary of Fountain creek, which in its turn flows into the Arkansas river.

The capacity of the reservoir is approximately 300 acre-feet with a depth of water of forty feet above the bottom of the outlet and a high-water area of about sixteen acres.

The dam is of concrete, 336 feet long on the crest, with a maximum height of sixty feet above the bottom of the foundation.

The dam is curved in plan, the face having a radius of 441.70 feet. The thickness at the bottom is twenty-seven feet and at the top seven feet.

The curved form of the structure is relied upon to give it part of the necessary stability, and its sufficiency for that purpose has been the subject of most searching examination by the designing engineer and by the State Engineer.

The foundation is solid and very hard granite. The excavation has been carried deep enough to remove the weathered and partially disintegrated rock.

The outlet conduit is a single line of thirty-inch standard cast iron pipe with leaded joints, surrounded by a thickness of six inches of concrete throughout its entire length.

At the inner end of this pipe, about eighty feet inside the face of the dam, is a concrete valve tower fifty-seven feet high above the bottom of the foundation, and eight feet in diameter inside.

The discharge through the outlet is controlled by a sluice gate inside of the tower. The admission of water to the valve tower itself is through two openings, each thirty inches in diameter, controlled by gate valves on the inside of the tower.

The freeboard is five feet. A spillway forty feet wide is excavated in solid rock around one end of the dam, and paved partly with concrete six inches thick, and partly with hand placed rock.

The plans and specifications for the work were prepared by Mr. G. H. Sethman, engineer, of Denver, and were approved by the State Engineer on November 1, 1912.

The work is in progress under the immediate supervision of Mr. George T. Prince and was examined by the State Engineer during the month of October, at which time it was proceeding in strict accordance with the plans and specifications, and in a satisfactory manner.

Cow Butte Reservoir No. 3

This reservoir is located in Section 30, Township 18 South, Range 55 West, and Section 25, Township 18 South, Range 56 West, 6th Principal Meridian, in Water District No. 17, Crowley county, Colorado.

It is formed by the construction of an earth dam across Black draw, a tributary of Horse creek, which in turn flows into the Arkansas river.

It has a capacity of about 620 acre-feet with a depth of water of twenty-five feet above the bottom of the outlet and a high-water area of about fifty acres.

The dam has a maximum height of thirty-four feet above the bottom of the draw and a length on the crest of 875 feet. The crest width is twelve feet and the inside and outside slopes are 2:1.

No special provision is made to cut off possible percolation under the dam. The inside slope is riprapped with granite boulders.

The bottom of the outlet is thirty feet below the crest of the dam. It consists of a reinforced concrete tube, two feet wide by three feet high inside, with bottom five inches thick, and with walls and arch eight inches thick.

This conduit is constructed in a trench about six feet deep, excavated in the natural earth.

The discharge from the reservoir is controlled by a steel sluice gate placed at the inner end of the conduit and operated from a wooden bridge communicating with the crest of the dam.

The freeboard is intended to be five feet but no provision for spillway is made.

Plans and specifications were prepared by Mr. E. F. Rizer, engineer, of Pueblo, and were approved by the State Engineer, subject to provision of adequate spillway, on November 14, 1912.

The State Engineer has not been advised of the commencement of construction work.

CHAPTER VIII.

INTERNAL IMPROVEMENTS

The business of this department for the biennial period has been limited to the completion of work initiated under the terms of laws enacted by the Seventeenth General Assembly. The Eighteenth General Assembly made no appropriations for new work to be done under the direction of this office.

The greater part of the work initiated during the biennial period 1909-10 was nearly completed during that period. However, many pieces of work remained which lacked finishing, and the completion of some details, to fully comply with the terms of the contracts under which they were built. As a result, complete financial statements concerning most of them could not be made in the Fifteenth Biennial Report.

During the biennial period just closed all of this unfinished business has been closed up and final statements of expenditures and balances are made in this chapter. The only important work which was not begun during the biennial period 1909-10 was the Pitkin county bridge.

Considerable difficulty was experienced in the preparation of a design for a bridge adapted to the site which could be built for the available funds. The construction of suitable road approaches was rather difficult because of the existence of a large amount of loose slide rock on one side of the canon. This condition practically fixed the location of the bridge and the elevation of the roadway.

Three different designs were prepared and bids invited on all of them. The final outcome is a satisfactory structure built at a cost which is moderate, considering the difficulties of the site, and approached by easy grades.

Arapahoe County Bridge

House Bill No. 120, Session Laws 1909, and page 142, Fifteenth Biennial Report of the State Engineer.

As only a small portion of the $5,000.00 appropriated became available no work has been done on this bridge.

Conejos County Bridge

House Bill No. 55, Chapter 16, Session Laws 1909, and page 143, Fifteenth Biennial Report of the State Engineer.

Construction work was started on this bridge early in July, 1911.

The work was done under the supervision of Mr. C. B. Sampson, of Alamosa, and was completed and final payment made on December 1, 1911.

FINANCIAL STATEMENT

Appropriated by State		$2,500.00
Expended prior to December 1, 1910	$ 9.02	
The M. F. Levy Construction Company, contract	2,490.98	
	$2,500.00	$2,500.00

Costilla County Bridge

Senate Bill No. 84, Chapter 18, Session Laws 1909, and page 144, Fifteenth Biennial Report of the State Engineer.

Construction work was begun on this bridge on February 22, 1911, and was completed in May, 1911.

The bridge was inspected by Charles E. Shimer and W. D. Waltman and accepted by the Board of Construction.

Final payment was made on June 7, 1911.

The county of Costilla paid $2,860.35 as its portion of the cost of this bridge.

FINANCIAL STATEMENT

Appropriated by State		$2,000.00
Expended prior to December 1, 1910	$ 9.10	
Charles E. Shimer, inspector	49.25	
The M. F. Levy Construction Company, contract	1,941.65	
	$2,000.00	$2,000.00

Conejos-Costilla Counties Bridge

Senate Bill No. 140, Chapter 17, Session Laws 1909, and page 144, Fifteenth Biennial Report of the State Engineer.

The erection of this bridge was begun late in January, 1911, under the supervision of Mr. C. B. Sampson, of Alamosa, and the work was completed and accepted on April 26, 1911. Final payment was made to the National Construction Company on April 28, 1911.

The counties of Conejos and Costilla paid the sum of $4,090.65 each as their proportion of the cost of this bridge.

FINANCIAL STATEMENT

Appropriated by State		$6,700.00
Expended prior to December 1, 1910	$2,519.21	
F. L. Easton, inspector	52.15	
Hilda Griffin, inspector's expense	12.50	
San Luis Hotel, inspector's expense	10.00	
Hildreth & Company, inspection of steel	70.87	
O. L. Nelson, inspector	17.20	
The National Construction Company, contract	4,018.07	
	$6,700.00	$6,700.00

Delta County Bridge

House Bill No. 85, Chapter 19, Session Laws 1909, and page 145, Fifteenth Biennial Report of the State Engineer.

The steel was manufactured by the Milwaukee Bridge Company, of Milwaukee, Wisconsin, and inspected by Hildreth & Company, of New York.

Erection work was begun about the middle of March, 1911, and was inspected by W. R. Gale, of Delta, final inspection being made by O. L. Nelson.

Work was completed and accepted and final payment was made to The Pueblo Bridge Company on September 7, 1911.

Delta county paid $7,898.00 as its portion of the cost of the bridge.

FINANCIAL STATEMENT

Appropriated by State		$3,750.00
Expended prior to December 1, 1910	$ 36.84	
Hildreth & Company, inspection of steel	46.64	
O. L. Nelson, inspector	10.50	
The Pueblo Bridge Company, contract	3,652.02	
Balance turned back into Internal Improvement Fund	4.00	
	$3,750.00	$3,750.00

Eagle County Bridge—Wilmot Ranch

Senate Bill No. 50, Chapter 14, Session Laws 1907, House Bill No. 174, Chapter 22, Session Laws of 1909, and page 147, Fifteenth Biennial Report of the State Engineer.

The steel for this bridge was fabricated by The Toledo Bridge & Crane Company, in Toledo, Ohio, under inspection by Hildreth & Company, of New York.

The bridge was completed and accepted and final payment was made to The Pueblo Bridge Company on April 10, 1911.

The county of Eagle paid $1,617.90 on this work.

FINANCIAL STATEMENT

Appropriated by State		$5,500.00
Expended prior to December 1, 1910	$ 35.53	
Hildreth & Company, inspection of steel	32.37	
The Pueblo Bridge Company, contract	5,432.10	
	$5,500.00	$5,500.00

Eagle County Bridge—Catamount Creek

Senate Bill No. 152, Chapter 21, Session Laws 1909, and page 146, Fifteenth Biennial Report of the State Engineer.

The bridge was completed and accepted and final payment was made to The Pueblo Bridge Company on December 2, 1910.

FINANCIAL STATEMENT

Appropriated by State		$1,000.00
Expended prior to December 1, 1910	$ 52.19	
The Pueblo Bridge Company, contract	947.81	
	$1,000.00	$1,000.00

Garfield County Bridge—Lacy

House Bill No. 37, Chapter 24, Session Laws 1909, and page 147, Fifteenth Biennial Report of the State Engineer.

This bridge was completed and accepted and final payment was made to The C. G. Sheely Contracting Company on March 3, 1911.

Garfield county paid $18,026.11 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$6,000.00
Expended prior to December 1, 1910	$ 178.30	
Hildreth & Company, inspection of steel	90.06	
O. L. Nelson, inspector	7.75	
The C. G. Sheely Contracting Company, contract	5,723.89	
	$6,000.00	$6,000.00

The high water of May and June, 1912, undermined the pier of this bridge and on June 7th, without any warning whatever, the pier rapidly settled straight downward, and both spans dropped into the river.

With the exception that all this took place so rapidly that there was no possibility of making any attempt to save the bridge, things passed here very much as at Una, described elsewhere in this chapter.

These two bridges were identical in design and construction, and the statement concerning the bridge at Una applies equally to this one.

The abutments at Lacy are practically uninjured, and a new steel span about 270 feet long resting on these abutments will be constructed. The spans of the old bridge will be taken out of the water and reconstructed at other crossings in Garfield county, to which their lengths will adapt them.

Garfield County Bridge—Una

Senate Bill No. 411, Chapter 23, Session Laws 1909, and page 148, Fifteenth Biennial Report of the State Engineer.

This bridge was completed and accepted and final payment was made to The C. G. Sheely Contracting Company on January 17, 1911.

Garfield County paid $20,241.43 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$4,000.00
Expended prior to December 1, 1910	$ 140.01	
Hildreth & Company, inspection of steel	90.67	
O. L. Nelson, inspector	10.75	
The C. G. Sheely Contracting Company, contract	3,758.57	
	$4,000.00	$4,000.00

About the middle of May, 1912, the State Engineer was advised that one end of the pier had settled. An examination by one of the engineers from this office showed that the up-stream end of the pier had settled four inches, the other end remaining undisturbed.

The County Surveyor of Garfield county stated that he had taken the elevations of various points on the bridge in December, 1911, and had found the same condition which prevailed at the time of our examination in the following May. This had not been reported to the State Engineer's office.

At the time of this examination, which was on May 18, 1912, the river was high and rising rapidly. Nothing could be done until the high water period had passed, and while the necessity for repairs was obvious, there appeared to be no immediate danger of losing the bridge.

On May 28 the State Engineer was advised that the up-stream end of the pier was again sinking. A pile bent was then driven as near as possible to the pier, and the truss span jacked up on that. The pier continued to sink slowly for several days and then came to a stop.

The difficulties in the way of this repair work with the facilities at hand were very great. The bottom of the river is covered with a mass of boulders through which piles can be driven only with great difficulty. They could not be driven to a penetration of more than 7.5 feet. The water was seventeen feet deep and it was impossible to place any sway bracing. The velocity of the water exceeded twelve feet per second, and in about a week the pile bent was carried away and the truss span dropped back onto the pier.

The pier had, in the meantime, been secured by steel cables passing around it, and anchored back to dead men on the shore. This prevented the pier from tipping over and enabled it to support the truss until the water subsided. Both spans were then jacked back into place and temporarily supported on timber structures until such time as the pier can be rebuilt.

The damage to the steel work is slight and the cost of repair will be trifling except for the removal of the old and the construction of a new pier. A new pier will contain about 350 cubic yards of concrete.

The immediate cause of the failure is obvious. The pier foundation was not carried down beyond the scouring effect of the river current. The cost of excavation and the placing of concrete in the pier foundation in the boulder bottom of the Grand river was excessive, amounting to about $300 for each additional foot of depth. The State Engineer attempted to draw a line between absolute stability and permanence and a moderate cost of construction which the public funds could afford. This resulted, as such attempts so often do, in an error on the wrong side, and the final expenditure of more money for reconstruction and repair than it would have cost originally to make the pier absolutely safe.

The bridge was saved from total destruction by the resourcefulness and tireless energy of Mr. J. W. Johnson, Deputy State Engineer, and Mr. Charles Switzer, who acted as foreman for The C. G. Sheely Contracting Company. These gentlemen worked night and day in the face of most discouraging difficulties, and at the risk even of their lives, since a single misstep would have precipitated them into a current running twenty miles an hour, from which any rescue would have been impossible. Their efforts undoubtedly prevented the pier from tipping to such an extent as to throw both spans into the river.

Lincoln County Bridge

House Bill No. 35, chapter 25, Session Laws 1909, and page 148, Fifteenth Biennial Report of the State Engineer.

The M. F. Levy Construction Company was ordered to paint this bridge at an agreed price of $150.00.

This work was completed and accepted and final payment was made to The M. F. Levy Construction Company on June 6, 1911.

FINANCIAL STATEMENT

Appropriated by State		$3,000.00
Expended prior to December 1, 1910	$2,790.89	
The M. F. Levy Construction Company, contract	150.00	
Balance turned back into Internal Improvement Fund	59.11	
	$3,000.00	$3,000.00

Mesa County Bridge

Senate Bill No. 264, Chapter 26, Session Laws 1909, and page 149, Fifteenth Biennial Report of the State Engineer.

After considerable discussion the board of county commissioners of Mesa county advertised for plans, specifications and bids for a completed bridge, and on January 5, 1912, received bids from the following:

The Patterson-Burghardt Construction Company.
Omaha Structural Steel Company.
James J. Burke & Company.
Charles G. Sheely.
The Missouri Valley Bridge Company.
The Minneapolis Steel & Machinery Company.
The Midland Bridge Company.
J. J. Lumsden.

The Patterson-Burghardt Construction Company was the lowest bidder, its price being $67,215.00.

A resolution was passed by the Board of Construction on the 8th day of January, 1912, as follows:

"It is hereby resolved and agreed by the undersigned that upon completion of said bridge according to contract, and to the satisfaction of the Governor, State Engineer and Chairman of the Board of County Commissioners, and upon proof being submitted satisfactory to the undersigned that sufficient moneys including the said appropriation are available to pay for the entire cost of the erection and construction of said bridge, and that the same will be paid, that the Governor, State Engineer and Chairman of the Board of County Commissioners of Mesa County, being the Board for the purpose of locating and constructing said bridge, shall prepare and approve a voucher for the balance then remaining in the fund created by said Act, to be used in paying for said bridge in accordance with said contract, and that thereupon said voucher shall be presented to the Auditor for a warrant.

IN WITNESS WHEREOF we have hereunto set our hands and seals this 8th day of January, A. D. 1912.

(Signed)
JOHN F. SHAFROTH, (Seal)
Governor of the State of Colorado.
CHARLES W. COMSTOCK, (Seal)
State Engineer of the State of Colorado.
THOS. DWYER,
Chairman of the Board of County Commissioners of Mesa County, Colorado.

O. K. BENJ. GRIFFITH,
Atty. General."

The concrete piers for this bridge are built and the steel is being manufactured by the Hansel-Elcock Company, of Chicago, and inspected by Hildreth & Company, of New York.

FINANCIAL STATEMENT

Appropriated by State		$6,480.00
Expended prior to December 1, 1912	$ 326.11	
Balance in fund	6,153.89	
	$6,480.00	$6,480.00

OURAY COUNTY BRIDGE

Senate Bill No. 45, Chapter 28, Session Laws 1909, and page 150, Fifteenth Biennial Report of the State Engineer.

The Board of Construction accepted the proposal of the Missouri Valley Bridge & Iron Company to build a sixty-six-foot light steel span, with tubular piers, and twenty-foot steel approaches, for the sum of $3,800.00.

After bridge was erected one chord was found to be out of alignment, due to an error in shop work. This chord was condemned and a new one put in by the contractor. The bridge was completed, accepted and final payment was made to the Missouri Valley Bridge & Iron Company on March 18, 1912.

Ouray county paid $422.36 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$3,480.00
Expended prior to December 1, 1910	$ 56.96	
O. L. Nelson, inspector	45.40	
Missouri Valley Bridge & Iron Company, contract	3,377.64	
	$3,480.00	$3,480.00

PITKIN COUNTY BRIDGE

House Bill No. 86, Chapter 22, Session Laws 1907; Senate Bill No. 354, Chapter 30, Session Laws 1909; House Bill No. 508, Chapter 31, Session Laws, 1909; and page 151, Fifteenth Biennial Report of the State Engineer.

New plans were prepared for a 180-foot steel span at an elevation of fifty feet above the bottom of canon, with a twenty-foot steel approach on each end, and concrete abutments. The work was advertised and bids received on October 21, 1911, as follows:

	Bidder	Price	Extra Concrete Per Cubic Yard	Date to be Completed
1.	The M. F. Levy Construction Company	$8,400.00	$12.00	May 1, 1912
2.	The Lowith Iron Works Company	8,895.00	12.00	Feb. 15, 1912
3.	Minneapolis Steel & Machinery Company	7,864.00	9.00	Feb. 21, 1912
4.	Midland Bridge Company	7,990.00	12.00	Apr. 21, 1912
5.	Missouri Valley Bridge & Iron Company	7,388.00	10.00	Apr. 21, 1912
6.	E. Gurtner & Company	8,950.00	10.00	Apr. 20, 1912
7.	The Colorado Ingot Iron & Pipe Company	7,725.00	9.00	Mch. 1, 1912
8.	The Patterson-Burghardt Construction Company	6,869.00	9.00	May 1, 1912

The Patterson-Burghardt Construction Company, of Denver, Colorado, was awarded the contract.

After some further deliberation the Board of Construction decided to prepare plans and advertise for bids for a 180-foot steel arch at an elevation of 66.5 feet above bottom of the canon.

This change in elevation permitted a much better approach to the bridge and decreased the amount of roadwork very materially.

In addition to the 180-foot arch there is a sixty-foot approach at each end, consisting of three steel spans of twenty feet each, making a total length of 300 feet.

Bids for this work were received on January 27, 1912, as follows:

	Bidder	Price	Extra Concrete per Cubic Yard	Date to Be Completed
1.	The Pueblo Bridge Company	$9,645.00	$13.00	Sept. 1, 1912
2.	Omaha Structural Steel Company	9,810.00	12.00	Sept. 1, 1912
3.	The Patterson-Burghardt Construction Company	9,575.00	11.00	July 15, 1912
4.	The M. F. Levy Construction Company	9,467.00	14.00	Aug. 20, 1912
5.	Missouri Valley Bridge & Iron Company	9,599.00	12.00	July 15, 1912

The M. F. Levy Construction Company asked permission to withdraw its bid. This was granted by the Board of Construction.

The former contract with The Patterson-Burghardt Construction Company was then cancelled by mutual agreement and a new contract awarded it by the Board of Construction.

The steel was fabricated by the Hansel-Elcock Company, of Chicago, and inspected by Hildreth & Company, of New York.

PITKIN COUNTY BRIDGE

Built by State Over Maroon Creek, Near Aspen, Colorado. Main Span, 180 Feet. Total Length, 300 Feet. Height Above Creek, 73 Feet

REINFORCED CONCRETE BRIDGE

Built by State of Colorado, in Costilla County. Span, 60 Feet. Roadway 16 Feet Wide

The concrete foundations were built under the supervision of Mr. George M. Post, representing the State Engineer. Two cubic yards of extra concrete were used.

The bridge was completed, accepted and final payment made to The Patterson-Burghardt Construction Company on November 12, 1912.

Pitkin county paid $77.74 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$9,724.00
Expended prior to December 1, 1910	$ 30.81	
The Rocky Mountain News, notice	1.52	
George M. Post, inspector	93.75	
The Aspen Democrat-Times, notice	2.31	
The Rocky Mountain News, notice	0.95	
Hildreth & Company, inspection of steel	58.35	
O. L. Nelson, inspector	15.85	
The Patterson-Burghardt Construction Company, contract	9,520.46	
	$9,724.00	$9,724.00

PUEBLO COUNTY BRIDGE

Senate Bill No. 50, Chapter 32, Session Laws 1909, and page 151, Fifteenth Biennial Report of the State Engineer.

The work of building a 100-foot steel span and concrete pier and abutments was advertised and bids received on February 18, 1911, as follows:

	Bidder	Price	Date to be Completed
1.	Missouri Valley Bridge & Iron Company	$10,200	July 1, 1911
2.	Midland Bridge Company	10,149	Aug. 1, 1911
3.	The Pueblo Bridge Company	9,998	Sept. 1, 1911

Contract was awarded to The Pueblo Bridge Company. The steel was manufactured by the Hansel-Elcock Company, of Chicago, and inspected by Hildreth & Company, of New York. The bridge was completed, accepted and final payment made on February 19, 1912. Pueblo county paid $5,058.73 as its portion of the cost and also paid for moving and erecting the old Union avenue bridge as one span of this bridge.

FINANCIAL STATEMENT

Appropriated by State		$5,000.00
Expended prior to December 1, 1910	$ 10.25	
L. D. Smith, typewriting	7.50	
The Rocky Mountain News, notice	2.53	
Pueblo Star Journal, notice	3.45	
Hildreth & Company, inspection of steel	37.00	
The Pueblo Bridge Company, contract	4,939.27	
	$5,000.00	$5,000.00

RIO BLANCO COUNTY BRIDGE

House Bill No. 62, Chapter 33, Session Laws 1909, and page 152, Fifteenth Biennial Report of the State Engineer.

This bridge was completed and accepted, and final payment was made to The M. J. Patterson Contracting Company on January 11, 1911. Rio Blanco county paid $1,554.71 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$3,750.00
Expended prior to December 1, 1910	$ 52.73	
Meeker Herald, notice	1.98	
The M. J. Patterson Contracting Company, contract	3,695.29	
	$3,750.00	$3,750.00

SUMMIT COUNTY BRIDGE

House Bill No. 201, Chapter 24, Session Laws 1909, and page 152, Fifteenth Biennial Report of the State Engineer.

New plans and specifications for an eighty-foot steel span were prepared by the State Engineer.

Work was advertised and bids received on February 25, 1911, as follows:

Bidder	Price	Date to Be Completed
1. The Patterson-Burghardt Construction Company	$4,000.00	July 1, 1911
2. Midland Bridge Company	4,510.00	July 1, 1911
3. C. L. Wilber & W., Wiborg	4,650.00	May 25, 1911

Contract was awarded to The Patterson-Burghardt Construction Company.

The steel was manufactured by the Hansel-Elcock Company, of Chicago, and inspected by Hildreth & Company, of New York.

Work was completed and accepted and final payment was made on October 3, 1911.

Summit county paid $537.85 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$3,500.00
Expended prior to December 1, 1910	$ 13.21	
The Rocky Mountain News, notice	1.92	
Hildreth & Company, inspection of steel	10.12	
O. L. Nelson, inspector	12.60	
The Patterson-Burghardt Construction Company, contract	3,462.15	
	$3,500.00	$3,500.00

TELLER COUNTY BRIDGE

Senate Bill No. 417, Chapter 35, Session Laws 1909, and page 152, Fifteenth Biennial Report of the State Engineer.

This work was completed and accepted and final payment was made to The Pueblo Bridge Company on January 11, 1911.

Teller county paid $110.27 as its portion of the cost.

FINANCIAL STATEMENT

Appropriated by State		$2,000.00
Expended prior to December 1, 1910	$ 164.57	
Julius Hornbein, inspector	55.70	
The Pueblo Bridge Company, contract	1,779.73	
	$2,000.00	$2,000.00

In the following cases the bridges were completed and accepted, and the balances shown below remaining in the funds appropriated after paying all bills, were turned back into the Internal Improvement Fund:

Clear Creek county bridge, Senate Bill No. 165, Chapter 15, Session Laws 1909, and page 145, Fifteenth Biennial Report of the State Engineer .... $ 62.61

Douglas county bridge, House Bill No. 526, Chapter 20, Session Laws 1909, and page 146, Fifteenth Biennial Report of the State Engineer 414.47

BOULEVARD—DENVER TO COLORADO SPRINGS

Senate Bill No. 488, Chapter 11, Session Laws 1909, and page 153, Fifteenth Biennial Report of the State Engineer.

This work was carried on as far as funds in the appropriation would allow.

Work was completed and final payment made to W. T. Rodney, contractor, on February 17, 1911, and to J. A. Osner, contractor, on November 21, 1911.

FINANCIAL STATEMENT

Appropriated by State		$ 2,000.00
From Platte Canon Boulevard fund, Senate Bill No. 288, 1907		14,689.28
Expended prior to December 1, 1910	$ 9,063.19	
H. M. Van Horn, rodman, salary and expenses	192.10	
J. A. Osner, contractor	5,126.00	
W. T. Rodney, contractor	1,998.56	
W. P. Woodside, surveying	177.50	
E. E. Montgomery, surveying	98.33	
Gregory Bennett, rodman	25.16	
T. C. Allen, Assistant Engineer, expenses	7.55	
Balance turned back into Internal Improvement Fund	0.89	
	$16,689.28	$16.689.28

Eagle County Road

House Bill No. 479, Chapter 94, Session Laws 1909, and page 156, Fifteenth Biennial Report of the State Engineer.

The contracts for Sections Nos. 1, 2, and 3 were completed and accepted and final payments made to contractors on December 30, 1910.

Plans and specifications were then prepared for Section No. 4 of this road. The work was advertised and bids received on March 27, 1911, as follows:

Bidder	Price	Date to be Completed
A. R. Gerard	$1,750.00	July 15, 1911
J. R. Gilmer	2,325.00	June 1, 1911
F. S. Smith	1,681.00	July 15, 1911

Contract was awarded to F. S. Smith and work was done under the supervision of W. H. Lea, County Surveyor of Eagle county. Work was completed and accepted and final payment made to contractor on August 14, 1911.

FINANCIAL STATEMENT

Appropriated by State		$7,500.00
Expended prior to December 1, 1910	$ 16.30	
Matt Murray, contractor	2,825.00	
Joe Johnson, contractor	700.00	
A. R. Gerard, contractor	1,657.60	
Rocky Mountain News, notice	1.60	
Eagle Valley Enterprise, notice	2.09	
F. S. Smith, contractor	1,714.45	
W. H. Lea, inspection	55.50	
Balance turned back into Internal Improvement Fund	527.46	
	$7,500.00	$7,500.00

Gilpin County Road—Moon Gulch

House Bill No. 514, Chapter 98, Session Laws 1909, and page 157, Fifteenth Biennial Report of the State Engineer.

This road was completed and accepted and final payment made to the contractor on October 3, 1911. Gilpin county paid $2.59 as its portion of the contract price.

FINANCIAL STATEMENT

Appropriated by State		$1,500.00
Expended prior to December 1, 1910	$ 95.92	
O. L. Nelson, inspector	3.35	
The Gilpin Observer, notice	3.32	
Henry Eatwell and P. C. McNevins, contractors	1,397.41	
	$1,500.00	$1,500.00

Gunnison County Road

House Bill No. 209, Chapter 101, Session Laws 1909, and page 158, Fifteenth Biennial Report of the State Engineer.

During the summer of 1911 the contractor completed his work in accordance with specifications and after inspection, the work was accepted and final payment made to Kasper Pressler on November 24, 1911.

FINANCIAL STATEMENT

Appropriated by State		$2,200.00
Expended prior to December 1, 1910	$1,538.08	
Kasper Pressler, contractor	500.00	
Balance turned back into Internal Improvement Fund	161.92	
	$2,200.00	$2,200.00

Lake County Road

House Bill No. 11, Chapter 103, Session Laws 1909, and page 159, Fifteenth Biennial Report of the State Engineer.

This road was completed and after inspection by the County Surveyor of Lake county, was accepted and final payment made to Louis Solem, the contractor, on July 31, 1911.

FINANCIAL STATEMENT

Appropriated by State		$3,800.00
Expended prior to December 1, 1910	$ 217.88	
Louis Solem, contractor	3,300.00	
McNair and Heitz, inspection	12.00	
Balance turned back into Internal Improvement Fund	270.12	
	$3,800.00	$3,800.00

Larimer County Road

Senate Bill No. 247, Chapter 104, Session Laws 1909, and page 159, Fifteenth Biennial Report of the State Engineer.

This road was completed and accepted and final payment made to James Ross, the contractor, on January 19, 1911.

FINANCIAL STATEMENT

Appropriated by State		$3,480.00
Expended prior to December 1, 1910	$ 382.60	
James Ross, contractor	3,097.40	
	$3,480.00	$3,480.00

Mineral County Road and Flume

House Bill No. 203, Chapter 105, Session Laws 1909, and page 160, Fifteenth Biennial Report of the State Engineer.

Final payment was made to Z. J. Wilson, contractor, on December 3, 1910.

FINANCIAL STATEMENT

Appropriated by State		$4,500.00
Expended prior to December 1, 1910	$1,063.26	
Z. J. Wilson, contractor	3,131.74	
William Stone, typewriting	13.95	
Shrive B. Collins, surveying	202.00	
Clemens Welle, County Commissioner, expenses	13.00	
Balance turned back into Internal Improvement Fund	76.05	
	$4,500.00	$4,500.00

Montrose County Road—Mexican Gulch

House Bill No. 434, Chapter 107, Session Laws 1909, and page 160, Fifteenth Biennial Report of the State Engineer.

Final payment was made to Frank H. Hill, contractor, on December 2, 1910.

FINANCIAL STATEMENT

Appropriated by State		$1,500.00
Expended prior to December 1, 1910	$1,026.10	
Frank H. Hill, contractor	473.90	
	$1,500.00	$1,500.00

Otero County Road—Rocky Ford to Fowler

Senate Bill No. 49, Chapter 108; House Bill No. 109, Chapter 109, Session Laws 1909, and page 162, Fifteenth Biennial Report of the State Engineer.

Final payment was made to L. C. Swink, the contractor, on December 2, 1910.

FINANCIAL STATEMENT

Appropriated by State, Senate Bill No. 49, 1909		$3,480.00
Appropriated by State, House Bill No. 109, 1909		2,250.00
Expended prior to December 1, 1910	$3,419.52	
L. C. Swink, contractor	2,310.48	
	$5,730.00	$5,730.00

Prowers-Bent Counties Road

House Bill No. 292, Chapter 111, Session Laws 1909, and page 163, Fifteenth Biennial Report of the State Engineer.

The Prowers county portion of this road was completed and accepted and final payment made to John C. Ford, the contractor, on December 3, 1910.

The Bent county portion was completed and accepted and final payment made to K. E. Banta, the contractor, on February 17, 1911.

FINANCIAL STATEMENT

Appropriated by State		$3,750.00
Expended prior to December 1, 1910	$ 27.08	
John C. Ford, contractor	1,800.00	
George M. Post, inspector	29.80	
K. E. Banta, contractor	1,800.00	
Balance turned back into Internal Improvement Fund	93.12	
	$3,750.00	$3,750.00

Pueblo-Custer Counties Road

Senate Bill No. 95, Chapter 115, Session Laws 1909, and page 164, Fifteenth Biennial Report of the State Engineer.

Final payment was made to Jacob Beck, chairman of the Board of County Commissioners of Custer county, for work done upon the Custer county portion of this road, on December 6, 1910.

FINANCIAL STATEMENT

Appropriated by State		$1,800.00
Expended prior to December 1, 1910	$ 914.72	
Jacob Beck, Chairman Board of County Commissioners	885.28	
	$1,800.00	$1,800.00

Yuma County Road

House Bill No. 227, Chapter 120, Session Laws 1909, and page 166, Fifteenth Biennial Report of the State Engineer.

The extra work on this road was completed and after examination was accepted, and final payment made to William E. Jordan, the contractor, on January 12, 1911.

FINANCIAL STATEMENT

Appropriated by State		$2,000.00
Expended prior to December 1, 1910	$1,553.02	
William E. Jordan, contractor	262.00	
Balance turned back into Internal Improvement Fund	184.98	
	$2,000.00	$2,000.00

In the following cases the respective balances as shown, remaining in the funds appropriated after paying all bills, were turned back into the Internal Improvement Fund:

Boulder-Grand counties road, House Bill No. 163, Chapter 56, Session Laws 1905, and page 154, Fifteenth Biennial Report of the State Engineer	$117.20
Chaffee county road—Poncha Pass, House Bill No. 163, Chapter 90, Session Laws 1909, and page 155, Fifteenth Biennial Report of the State Engineer	8.50
Chaffee-Eagle counties road, Senate Bill No. 347, Chapter 53, Session Laws 1903, and page 155, Fifteenth Biennial Report of the State Engineer	18.35
Clear Creek county road—Green Lake, Senate Bill No. 444, Chapter 91, Session Laws 1909, and page 155, Fifteenth Biennial Report of the State Engineer	58.97
Hinsdale county road—Lake City to Creede, House Bill No. 202, Chapter 102, Session Laws 1909, and page 158, Fifteenth Biennial Report of the State Engineer	5.65
Montrose county road, Senate Bill No. 296, Chapter 103, Session Laws 1907, and page 160, Fifteenth Biennial Report of the State Engineer	4.12
Montezuma county road—Menefee Siding to Rush's Basin, House Bill No. 198, Chapter 106, Session Laws 1909, and page 161, Fifteenth Biennial Report of the State Engineer	148.94
Pitkin county road No. 3—Lincoln Gulch to Lake Creek, House Bill No. 65, Chapter 105, Session Laws 1907, and page 164, Fifteenth Biennial Report of the State Engineer	192.72
San Juan county road—Silverton to Creede, House Bill No. 129, Chapter 117, Session Laws 1909, and page 165, Fifteenth Biennial Report of the State Engineer	58.01
San Miguel county road—Ophir to Vance Junction, House Bill No. 505, Chapter 119, Session Laws 1909, and page 165, Fifteenth Biennial Report of the State Engineer	85.62
Santa Fe trail, Senate Bill No. 91, Chapter 70, Session Laws 1907, and page 167, Fifteenth Biennial Report of the State Engineer	633.86

Kiowa County Artesian Well

House Bill No. 23, Chapter 7, Session Laws 1909, and page 167, Fifteenth Biennial Report of the State Engineer.

This well was driven to a depth of 916 feet. Of this distance 863 feet was cased and fifty-three feet was not cased.

At a depth of 883 feet a water bearing stratum of Dakota sand stone was struck. The water rose to within 133 feet of the surface.

This contract was completed and well accepted, and final payment made to E. R. Good, the contractor, on December 12, 1911.

FINANCIAL STATEMENT

Appropriated by State		$5,000.00
Expended prior to December 1, 1910	$ 49.06	
E. R. Good, contract	4,475.76	
A. D. Wickersham, superintendent	475.00	
Balance turned back into Internal Improvement Fund	0.18	
	$5,000.00	$5,000.00

MONTEZUMA COUNTY ARTESIAN WELL

Senate Bill No. 44, Chapter 8, Session Laws 1909, and page 168, Fifteenth Biennial Report of the State Engineer.

On May 19, 1911, a bid was submitted for the drilling of this well by Fred P. Davy, of Cortez, Colorado, at a price of $6.00 per foot.

Contract was awarded to Mr. Davy and the well was drilled to a depth of 658 feet.

The first 130 feet, which is twenty feet into bed rock, was cased with ten-inch, inside diameter, casing. The hole was finished with a ten-inch bit. Water was struck at a depth of 570 feet and rose to within 290 feet of the surface.

Drilling was stopped in a white sandstone formation which showed no indication of gas, oil or water. The only water struck was that at 570 feet below surface.

This contract was completed and after examination by J. W. Johnson, Deputy State Engineer, the work was accepted and payment made Fred P. Davy, the contractor, on August 15, 1911.

FINANCIAL STATEMENT

Appropriated by State		$3,850.00
Expended prior to December 1, 1910	$ 46.11	
Fred P. Davy, contractor	3,803.89	
	$3,850.00	$3,850.00

CHAPTER IX.

WATER POWER DEVELOPMENT

With a view to determining as far as possible the extent of water power development in the State of Colorado, blank forms were prepared and supplied to the hydrographers with instructions to visit all water power plants in their respective territories and obtain as much as possible of the information called for by these forms. The forms call for the following information:

1. Name of stream on which power is located.
2. In what main drainage area?
3. Location of power in township, county; above or below what tributaries?
4. Name of mill or power station.
5. Name and address of owner or operator.
6. What discharge records have been kept? By whom? Where obtainable?
7. Installed capacity (horse power).
8. Use to which power is applied.
9. Market price of power in this locality.
10. Method of supplying water to wheels (canal or flume, pipe line, etc.).
11. Operating capacity of canal or pipe line, cubic feet per second.
12. Pondage (approximate area, range of head, capacity, flashboards).
13. Storage capacity, acre-feet.
14. Total operating head forebay to tail race.
15. Water wheels (if impulse wheel, give diameter and number of nozzles):

No. of Wheel	Kind of Wheel	Name of Maker	Diameter of Wheel (Inches)	Rated Power	Speed (Revs. per Min.)	Remarks

16. Water wheel governors (automatic or otherwise, make).
17. Generators, A. C. or D. C.? Direct connected or belted? Speed?

No.	Make	Kilowatts	Voltage	Phase	Current	Connection	Remarks

18. Transmission lines (location, length, phase, voltage, size and kind of wire, kind of poles, etc.).
19. Hours per day plant runs.
20. Auxiliary steam plant. Rated power? Kind of boilers and engines?
21. What part of year is water-supply sufficient?
22. When was plant built?
23. Additional remarks. (If possible get picture of the plant.)

While it is possible that some plants were overlooked it is believed that the following list covers more than ninety-five per cent. of the existing water-power development in the State.

There are thirty-three power plants aggregating 71,575 horsepower, distributed as follows:

In the South Platte drainage area fourteen plants generating 22,571 horsepower.

In the Arkansas drainage area three plants generating 5,525 horsepower.

In the Grand river basin twelve plants generating 29,021 horsepower.

On the San Miguel river two plants generating 6,433 horsepower.

On the Animas one plant generating 8,000 horsepower.

On the Yampa river one plant generating twenty-five horsepower.

Of the total water power so far developed in the State more than one-half is generated by the two plants belonging to the Central Colorado Power Company, one on Boulder creek and one on the Grand river.

South Platte Drainage

CENTRAL COLORADO POWER COMPANY

This plant is located on Boulder creek about four miles above the City of Boulder. The installed capacity is 21,000 horsepower in two units. Water is stored in Barker Meadows reservoir which has a capacity of about 12,000 acre feet. From there it flows through a concrete pipe line thirty-six inches in diameter and about twelve miles long to the Kossler reservoir at the head of the pressure line. The pressure line is a single steel pipe forty-two inches in diameter and 9,500 feet long leading directly to the wheels. The operating head is 1,800 feet. A discharge of 140 cubic feet per second is necessary to operate the plant to its full capacity. The stor-

age in Barker Meadows reservoir is equivalent to 5,700 day-second-feet and the pondage at the head of the pressure line is sixty-six day-second-feet. There are two impulse wheels of the Pelton type, manufactured by the I. P. Morris Company, of Philadelphia. Each wheel is 103 inches in diameter, runs at 400 revolutions per minute and has a rated horsepower of 10,500. There is one six-inch nozzle to each wheel. Regulation is by means of a needle operated by an I. P. Morris automatic governor. Each wheel is direct connected to a General Electric three-phase 5,000-kilowatt generator, operating at 4,000 volts. Power is transmitted to Denver, a distance of approximately thirty-five miles, by a three-phase line at 100,000 volts. This line is constructed with steel towers and suspension insulators. Power is transmitted to the north on a line about sixty miles long at 13,000 volts. This line is constructed on cedar poles. This plant is operated twenty-four hours per day and from May 1 to November 1 the water supply is generally sufficient for the operation of the plant without drawing on the storage. The tail race from this plant discharges into Boulder creek above the headgates of all irrigation canals, and its operation, therefore, does not interfere with the subsequent use of the water for irrigation purposes. The plant was completed and put in operation in 1910. The price at which power is sold is variable with the character of the service, the length of the contract and the amount of power contracted for. It is, therefore, impossible to state any average rate.

WOLFE TONGUE MINING COMPANY

This plant is located on Middle Boulder creek above the mouth of North Boulder. It consists of one Leffel turbine wheel, 15¼ inches in diameter, operating at 900 revolutions per minute and rated at 100 horsepower. It is regulated by a Woodward automatic governor. The operating head is ninety-one feet and the plant requires twenty cubic feet of water per second. The wheel is direct connected to a General Electric three-phase 100-kilowatt generator. operating at 480 volts. The plant runs twelve hours per day and the entire output is consumed in the operation of a concentrating mill immediately adjoining the power plant. The water supply is sufficient from about May 1 to November 1 of each year. This plant was built in the fall of 1911. There is an auxiliary steam plant consisting of an eighty-horsepower tubular boiler and an automatic engine for use during low-water periods.

BAILEY MILL

This plant is located on Middle Boulder creek above the mouth of North Boulder in Township 1 South, Range 73 West, 6th Principal Meridian. It is the property of the Colorado Metals & Chemical Company. No information concerning it was obtainable at the time of the hydrographer's visit in August, 1912.

LIVINGSTON MILL

This plant is located on North Boulder creek in Township 1 North, Range 72 West, 6th Principal Meridian. It is the property of the United States Gold Corporation. The plant is an old one, having been built in 1888, and very little information concerning it is obtainable. There is one turbine wheel which is stated to require thirty-nine cubic feet of water per second. The plant runs twenty-four hours per day, and the water supply is said to be sufficient from May 1 to December 1.

PRUSSIAN MILL

This plant is located on Left Hand creek in Township 1 North, Range 72 West, 6th Principal Meridian, in Boulder county. It consists of one Pelton wheel seventy-two inches in diameter and rated at 125 horsepower. The operating head is ninety-five feet. There is no governor, uniformity of load and hand regulation being relied upon. The power is used for the operation of a mill. There is an auxiliary steam plant of eighty horsepower, which has been used almost to the total exclusion of the water power plant since 1907. The water power plant was installed in 1892.

WHITE RAVEN MINE

This plant is located on Left Hand creek in Townsship 1 North, Range 72 West, 6th Principal Meridian, in Boulder county. It consists of a single turbine wheel, ten inches in diameter rated at fifty horsepower, operating under a head of sixty-four feet and requiring twelve cubic feet of water per second. The power is used to drive an air compressor and no governor is used. The plant was built in 1910 and runs twenty-four hours per day. The water supply is sufficient from May 1 to October 1. There is an auxiliary steam plant consisting of an engine and sixty-horsepower locomotive boiler.

PRINCE ARTHUR MILL

This plant is located on Left Hand creek in Township 1 North, Range 72 West, 6th Principal Meridian, in Boulder county. It consists of a Hug water wheel forty-eight inches in diameter rated at 100 horsepower and running at 220 revolutions per minute. The wheel is fitted with two nozzles one and one-half and two inches in diameter, respectively. The operating head is 150 feet. The power is consumed in the operation of a mill. There is at present no governor but the owners contemplate the installation of a Lombard governor. A Westinghouse three-phase generator operating at 440 volts and 900 revolutions per minute, is to be installed and belted to the water wheel. The plant was built in 1907 and runs twenty-four hours per day. The water supply is sufficient from February 1 to December 1. There is no auxiliary plant, but it is planned to install oil engines for this purpose.

WHITE DIAMOND MILL

This plant is located on Jim creek in Township 2 North, Range 72 West, 6th Principal Meridian, in Boulder county. It consists of one turbine wheel twenty inches in diameter, rated at seventy horsepower. The operating head is seventy feet and the water required about twenty-five cubic feet per second. There is no governor. The plant runs twenty-four hours per day and the power is used for the operation of a mill. The plant was built in 1890. The water supply is sufficient from May 1 to December 1.

ESTES PARK ELECTRIC LIGHT & POWER COMPANY

This plant is located on Fall river, a tributary of the Big Thompson, in Larimer county. It consists of one Hug wheel forty inches in diameter rated at 270 horsepower and operating at 360 revolutions per minute. The operating head is 407 feet and the quantity of water required is twelve cubic feet per second. Regulation is by means of a Pelton automatic governor. The wheel is direct connected to a Westinghouse single-phase 200-kilowatt generator, operating at 3,300 volts. The power is entirely consumed for lighting in Estes Park, and the maximum transmission distance is four miles. The plant runs twenty-four hours per day and the water supply is sufficient eleven months in the year. The plant was built in 1909.

DIXON MILL

This plant is located on St. Vrain creek in Boulder county about two miles below the town of Longmont. It consists of a Leffel turbine wheel rated at thirty horsepower and running at 300 revolutions per minute. The operating head is eighteen feet and the quantity of water required is twenty cubic feet per second. The wheel is used either for running a grist mill or driving a generator. The generator is a Westinghouse three-phase 100-kilowatt machine, operating at 2,300 volts and 600 revolutions per minute. It is belted to the wheel. Electric power is transmitted about one and one-half miles to the plant of the Great Western Sugar Company at Longmont. There is no auxiliary steam plant. The plant was built in 1900 and remodeled in 1904. The generator was added in 1910. Taking the average for a year the plant is capable of generating thirty horsepower about half the time. There is water sufficient to drive the generator about sixty days during the year.

LONGMONT HYDRO-ELECTRIC PLANT

This is located on North St. Vrain creek in Township 3 North, Range 71 West, 6th Principal Meridian, in Boulder county. The installed capacity is 500 horsepower. There are two Pelton wheels, each thirty-three inches in diameter, rated at 250 horsepower and operating at 600 revolutions per minute. The operating head is 400 feet, and the quantity of water required is eight cubic feet per second. Regulation is by means of a Pelton automatic governor. Each wheel is direct connected to a Ft. Wayne three-phase 250-kilowatt generator, operating at 2,300 volts. The transmission line is thirteen miles long, and is operated at three-phase and 11,000 volts. The plant is owned by the town of Longmont and the power is consumed for municipal lighting. The plant runs twenty-four hours per day. There is no auxiliary steam plant. The plant was built in 1911, and the water supply is thought to be sufficient for ten months in the year.

FORT COLLINS MILL & ELEVATOR COMPANY

This plant is located on the Cache la Poudre river in Township 7 North, Range 69 West, 6th Principal Meridian, in Larimer County. It consists of one Leffel turbine wheel thirty-six inches in diameter, rated at 149 horsepower and operating at 200 revolutions per minute. The operating head is twenty-five feet and the quantity of water required is sixty cubic feet per second. There is no governor. The power is used to drive a flour mill. The plant runs twelve hours per day and the water supply is sufficient from April 1 to November 1. There is an auxiliary steam plant consisting of a 100-horsepower Corliss engine and tubular boilers. The first plant was installed here in 1865 and it was remodeled in 1896.

HOFFMAN MILLING COMPANY

This plant is located on the Cache la Poudre river in Township 7 North, Range 61 West, 6th Principal Meridian, in Larimer county. It consists of two turbine wheels, each thirty-six inches in diameter, rated at forty-six horsepower and operating at 106 revolutions per minute. The operating head is twelve feet and the quantity of water required is fifty cubic feet per second. There is no governor. The power is used to drive a flour mill. The plant runs sixteen hours per day and the water supply is sufficient from March 1 to January 1. The plant was built in 1894. There is an auxiliary steam plant consisting of a forty-horsepower engine and a locomotive boiler.

LOWER PLATTE AND BEAVER DITCH COMPANY

This plant is located on the Lower Platte and Beaver canal in Section 19, Township 4 North, Range 55 West, 6th Principal Meridian, in Logan county. The installed capacity is sixty horsepower and the power is used to pump water for irrigation. The plant consists of a Leffel turbine wheel thirty inches in diameter, operating at 247 revolutions per minute. The operating head is 11.6 feet. Water used to drive the plant is tail water from the Lower Platte and Beaver canal and about sixty cubic feet per second is required.

ARKANSAS DRAINAGE

BUENA VISTA ELECTRIC LIGHT & POWER COMPANY

This plant is located on the Arkansas river at the town of Buena Vista in Chaffee county. It consists of Leffel twin turbines 30½ inches in diameter on a horizontal shaft running at 210 revolutions per minute and rated at 125 horsepower. There are no water wheel governors. The operating head is twenty-one feet and the

amount of water required is 125 cubic feet per second. There is no pondage and the output of the plant is limited by the quantity of water flowing in the river. The turbine is belted to an eighty-kilowatt General Electric direct current generator running at 550 revolutions per minute and operating at 550 volts. Power is transmitted only one-half mile and is used for lighting and power in the town of Buena Vista and at the Colorado State Reformatory. Distribution is on a 230-460 volt three wire system. The plant was built in 1888-9 and runs twenty-four hours per day. The water supply is sufficient at all times except during December, January and February of some years. There is no auxiliary steam plant. Power is sold at twelve cents per kilowatt-hour.

SKAGUAY STATION OF THE ARKANSAS VALLEY RAILWAY, LIGHT & POWER COMPANY

This plant is located in Section 30, Township 16 South, Range 68 West, 6th Principal Meridian, on West Beaver creek, a tributary of the Arkansas river, in Fremont county. The plant has four units, each consisting of two Pelton wheels sixty-three inches in diameter, running at 450 revolutions per minute. Each unit is rated at 600 horsepower. The operating head is 1,150 feet and the quantity of water required is twenty cubic feet per second. Water is stored in a reservoir of 3,275 acre-feet capacity, from which it is conducted through a wooden stave pipe to the head of the pressure line. The pressure line is a steel pipe about 4,000 feet long. Two of the power units have Sturgess automatic governors. The other two are hand regulated. Each pair of wheels is direct connected to a 400-kilowatt General Electric three-phase generator, operating at 600 volts. The power is fed into a main transmission line extending to Pueblo, Canon City and Cripple Creek, the total length of the line being about eighty miles. Transmission is three-phase at 24,000 volts. The plant was built in 1901. It runs from four to twenty-four hours per day, depending upon the water supply. The water supply is usually sufficient in July, sometimes in August. Two steam plants feed the transmission system. One of them, located at Canon City, has a capacity of 4,700 kilowatts, is equipped with Babcock & Wilcox and Heine boilers, Corliss engines and high pressure and low pressure steam turbines. The other plant, located at Pueblo, has a capacity of 3,500 kilowatts Power is sold at prices ranging from one and one-half to four cents per kilowatt-hour, depending on load-factor, amount contracted for and other similar elements.

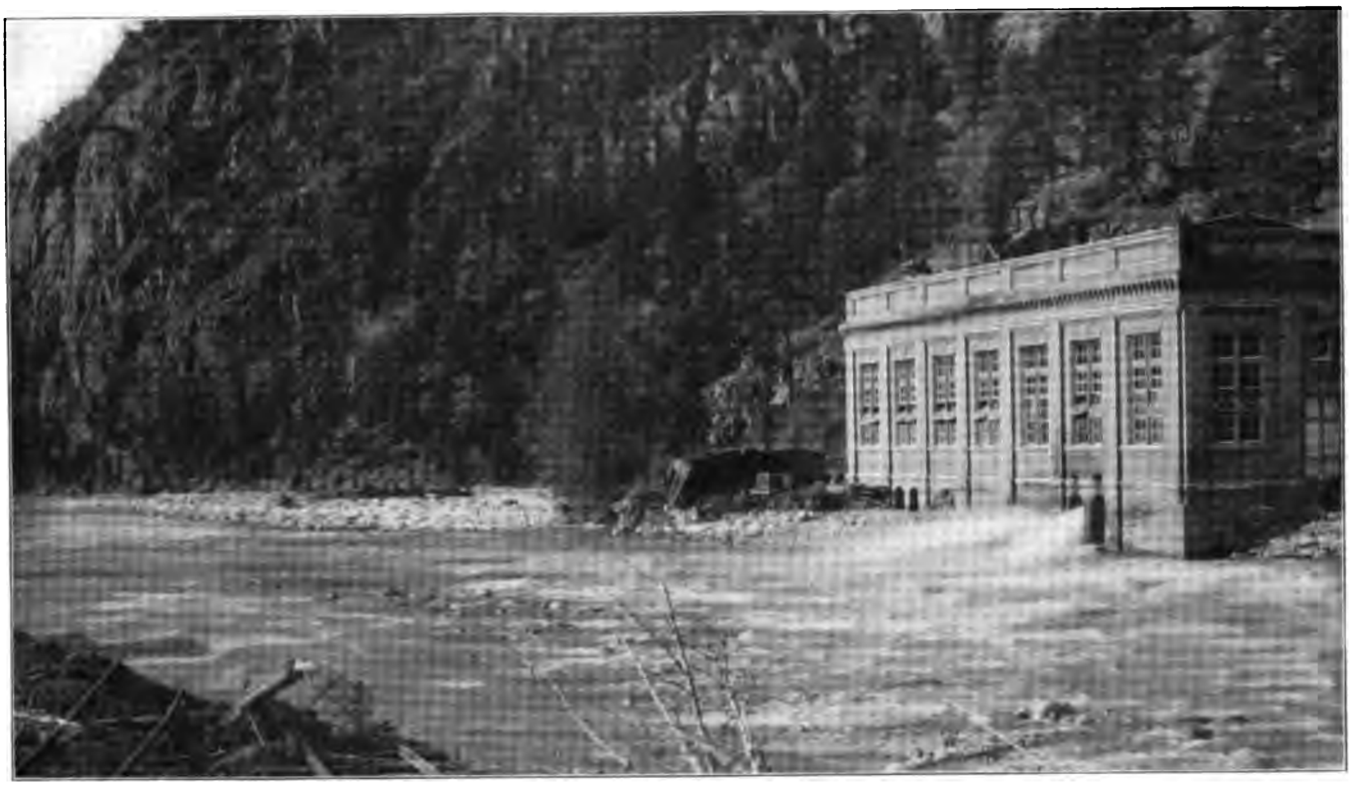
PIKE'S PEAK STATION OF THE COLORADO SPRINGS LIGHT, HEAT & POWER COMPANY

This plant is located in Township 14 South, Range 67 West, 6th Principal Meridian, in El Paso county. It receives its water supply from Ruxton creek, a tributary of Fountain creek, which in turn flows into the Arkansas river. The installation consists of three Pelton wheels, one ninety-one inches in diameter and two eighty-four inches in diameter, each rated at 1,000 horsepower and operating at 450 revolutions per minute. These wheels are controlled by Lombard governors. The operating head is approximately 2,600 feet, this being the highest head water power plant in the United States and, with two exceptions, the highest head in the world. The pressure line is a steel pipe twenty inches in diameter and about 17,000 feet long. The quantity of water required is twenty-nine cubic feet per second. Water is drawn from the storage reservoirs of the city of Colorado Springs. After passing through this plant it is again taken up in the distributing reservoirs belonging to the Colorado Springs water supply. Each water wheel is direct connected to a 750-kilowatt General Electric three-phase generator, operating at 6,600 volts. The transmission is about three miles long to a switching station where the current is fed into the line supplying Colorado Springs, Colorado City and Manitou. There are two three-phase 6,600-volt lines. The plant was built in 1903. It operates twenty-four hours per day but the load varies with the water supply. The quantity of water used is regulated by the demands of the city of Colorado Springs. This plant operates in parallel with a steam plant of 4,750 kilowatts capacity, located at Colorado Springs. This plant is equipped with Babcock & Wilcox boilers, compound engines and high and low pressure steam turbines.

Grand River Drainage

SHOSHONE PLANT OF THE CENTRAL COLORADO POWER COMPANY

This plant is located on the Grand river about ten miles east of Glenwood Springs, above the mouth of the Roaring Fork and below the mouth of the Eagle river. A bear trap diversion dam is built across the Grand river and by means of this, water is diverted through a concrete lined tunnel about two and one-half miles long and with a carrying capacity of 1,250 cubic feet per second. This tunnel is approximately parallel with the river and is used instead of an open canal or flume built in the canon, either one of which would be extremely difficult of construction and impossible of maintenance. From the lower end of this tunnel the water is led by means of steel penstocks to the wheels. There are two turbine wheels, each fifty-four inches in diameter, running at 400 revolutions per minute, rated at 9,000 horsepower and controlled by automatic governors. Both wheels and governors are built by the I. P. Morris Company, of Philadelphia. The operating head is 175 feet. Each wheel is direct connected to a General Electric 5,000-kilowatt three-phase generator, operating at 4,000 volts. Power is transmitted 180 miles to Denver and to various intermediate towns and mining camps. The transmission is three-phase at 100,000 volts. The line is built on steel towers. The plant was built in 1909. During the summer months the water supply is sufficient to operate the plant at full load but during the fall and winter there is sufficient water for only a fraction of the installed capacity. The plant runs twenty-four hours per day on whatever load the water supply will permit it to carry. This company owns a steam plant at Leadville, which is run in parallel with the hydro-electric plant at Shoshone. The steam plant consists of 2,000 horsepower of water tube boilers of Heine, Babcock & Wilcox and Sterling types, one cross-compound engine and two steam turbines direct connected to Bullock generators. The Shoshone plant and the Boulder plant, owned by the same company and previously described herein, are operated in parallel so that the load may be distributed between the two in whatever way may be desired.



HYDRO-ELECTRIC PLANT AT ROCKWOOD

San Juan Water & Power Company. Horsepower, 8,000. Head, 970 Feet

MORRIS PUMP STATION OF THE GRAND VALLEY IRRIGATION DISTRICT

This plant is located in Section 29, Township 6 South, Range 94 West, 6th Principal Meridian, in Garfield county. It utilizes a drop in the Willcox canal of the Grand Valley Irrigation District to pump water into two high level canals. The installed capacity is 280 horsepower, consisting of two "Samson" turbines, each seventeen inches in diameter, running at 625 revolutions per minute and rated at 140 horsepower. There are no governors. The total operating head is fifty feet. No storage is provided. Each wheel is direct connected to an Alberger centrifugal pump by which water is elevated to the high-level canals. The power is used exclusively for pumping purposes and the time of operation depends entirely upon the demand for irrigation water.

REDLANDS IRRIGATION & POWER COMPANY'S PLANT

This plant is located on the Grand river, below the mouth of the Gunnison river, in Section 16, Township 1 South, Range 1 West, Ute Meridian, in Mesa county. Water is diverted from the river through an open canal and supplied to the wheels through a steel pipe. There are two Leffel turbines, each forty-eight inches in diameter, running at 360 revolutions per minute and rated at 1,000 horsepower. Both Lombard and Woodward automatic governors are in use. The operating head is forty feet, and the quantity of water required is 550 cubic feet per second. These wheels drive two General Electric 450-kilowatt three-phase generators, operating at 2,300 volts. Power is used for lighting and general utility purposes in the city of Grand Junction and in pumping water for irrigation in the surrounding country. The maximum transmission distance is four miles. The transmission is three-phase at 11,000 volts. There is no storage but the water supply is sufficient at all times of the year. The plant runs twenty-four hours per day. It was built in 1906. There is no auxiliary steam plant. Power is sold wholesale at one and one-eighth cents per kilowatt-hour and retail at twelve and one-half cents.

ORCHARD MESA PLANT

This plant is located on the Grand river below the mouth of the Gunnison, in Section 2, Township 1 South, Range 2 East, Ute Meridian, in Mesa county. The power is used exclusively to pump water for irrigation of the Orchard Mesa Irrigation District. The installed capacity is 2,250 horsepower. The plant consists of Leffel turbines running at 490 revolutions per minute and controlled by automatic governors. The operating head varies from eighty feet at low water to seventy-five feet at high water. The quantity of water required is 450 cubic feet per second. The plant runs twenty-four hours per day during the irrigation season and the water supply is sufficient at all times without the need of storage. The plant was built in 1910.

CASTLE CREEK PLANT

This plant is located in Township 10 South, Range 84 West, 6th Principal Meridian, in Pitkin county, and derives its water supply from Maroon, Castle and Hunter creeks, tributaries of the Roaring Fork, which in its turn discharges into the Grand river. It is the property of the Roaring Fork Electric Light & Power Company. The installed capacity is 2,900 horsepower. Water is brought from Maroon creek through 4,000 feet of thirty-inch pipe, with a head of 356 feet, from Castle creek through 4,000 feet of twenty-four-inch pipe, with a head of 340 feet, and from Hunter creek through two miles of fourteen-inch pipe, with a head of 876 feet. There is a pondage amounting to about thirty acre-feet on Hunter creek. There are four Pelton wheels, each fifty-seven inches in diameter, running at 300 revolutions per minute and rated at 250 horsepower. Each wheel has two nozzles. There is one Doble wheel eighty-four inches in diameter, running at 300 revolutions per minute and rated at 500 horsepower. There are two Doble wheels, each sixty inches in diameter, running at 300 revolutions per minute and rated at 700 horsepower. The last three wheels have only one nozzle each. The plant contains five automatic governors, three of the Lombard and two of the Replogle type. The electrical equipment consists of six generators. Two of these are used for lighting exclusively, are belt operated at 600 revolutions per minute, and each is of 200 kilowatts capacity. There are two generators direct connected, running at 300 revolutions per minute, at 600 volts, each of 400 kilowatts capacity. There are two generators belt connected, running at 425 revolutions per minute, at 600 volts and each of 200 kilowatts capacity. All of these are direct current machines. The lighting current is transmitted one and one-half miles at 1,100 volts. The power current is transmitted on the three wire system at 600-1200 volts. The plant was built in 1892 and has been operated continuously for twenty years. The water supply is sufficient practically all the time and no auxiliary steam plant is provided. Power is consumed for mining and milling purposes and for lighting the town of Aspen. The market price of power is $37.50 per horsepower per annum.

CRYSTAL RIVER MARBLE COMPANY'S PLANT

This plant is located on Yule creek, about three miles above its mouth where it discharges into Crystal river, a tributary of the Roaring Fork, in Gunnison county. It is the property of the Crystal River Marble Company and power is used in the operation of this company's mill. The installed capacity is 425 horsepower. Water is led through a pipe line from Yule creek to two Leffel turbine wheels, each twenty-eight inches in diameter, running at 600 revolutions per minute and rated at 212 horsepower. The wheels are controlled by Lombard governors. The operating head is ninety feet and no storage is provided. Each wheel is direct connected to a 150-kilowatt three-phase generator, operating at 2,300 volts. The transmission line is one mile long and the transmission is three-phase at 2,300 volts. There is an auxiliary steam plant of 300 horsepower, consisting of return tubular boilers, Ames engine and Fort Wayne generator. The water supply is insufficient in winter. The plant was built in 1909 but has not been in use since the fall of 1911.

The plant was built in 1897 and has been running all told about eleven years. When the mine and mill are in operation the plant runs twenty-four hours per day.

OURAY POWER COMPANY'S PLANT

This plant is located on the Uncompahgre river in the town of Ouray, in Ouray county. It consists of two Pelton wheels, each of about 300 horsepower and operating at 300 revolutions per minute. The wheels are not provided with governors. The operating head is 430 feet. There are two generators, both of the Westinghouse type. The first is a 300-kilowatt machine operating at two-phase and 2,400 volts. The second is a 150-kilowatt single-phase machine operating at 2,200 volts. The maximum transmission distance is eleven miles and the transmission is at 11,000 volts. No storage is provided and there is no auxiliary steam plant. The water supply is sufficient at all times of the year. The plant runs twenty-four hours per day. Power is consumed for municipal purposes in the town of Ouray and for mining purposes in the surrounding country.

San Miguel Drainage

TELLURIDE POWER COMPANY'S PLANT AT AMES

This plant is located in Section 24, Township 42 North, Range 10 West, New Mexico Principal Meridian, in San Miguel county. The plant consists of two Pelton wheels. One of these is eighty-four inches in diameter, runs at 225 revolutions per minute and is rated at 1,206 horsepower under a head of 613 feet. It receives its water supply from Howard's Fork of the San Miguel river. The other has a diameter of 120 inches, runs at 225 revolutions per minute and is rated at 3,619 horsepower under a head of 926 feet. It receives water both from Howard's Fork and Lake Fork of the San Miguel. There is an available storage capacity of about 5,000 acre-feet from which this wheel can draw its supply. Both wheels are provided with Pelton automatic governors and are direct connected to one generator. This is a General Electric 3,600-kilowatt three-phase machine. The maximum transmission distance is about ten miles and the transmission is at three-phase and 11,000 volts. The water supply is sufficient at all times of the year and no auxiliary steam plant is provided. The plant runs twenty-four hours per day. It was originally built in 1892 and was rebuilt in 1907. Power is consumed for mining, milling and general purposes in the town of Telluride and surrounding country.

TELLURIDE POWER COMPANY'S PLANT AT ILIUM

This plant is located in Section 6, Township 42 North, Range 9 West, New Mexico Principal Meridian, in San Miguel county. It derives its water supply from the South Fork of the San Miguel river. It consists of two Pelton wheels, each seventy-two inches in diameter, running at 200 revolutions per minute and rated at about 800 horsepower under a head of 530 feet. No governors are provided. These wheels are direct connected to a General Electric 1.200-kilowatt three-phase generator, operating at 1,000 volts. Power is transmitted at three-phase and 11,000 volts, the maximum transmission distance being about ten miles. The water supply is sufficient at all times of the year and there is no storage and no auxiliary steam plant. The plant was built in 1902 and runs twenty-four hours per day. It is operated in parallel with the Ames plant of the same company.

Animas Drainage

SAN JUAN WATER & POWER COMPANY'S PLANT AT ROCKWOOD

This plant is located in Section 31, Township 38 North, Range 8 West, New Mexico Principal Meridian, in La Plata county. It derives its water supply from Cascade and Elbert creeks, tributaries of the Animas river. The plant consists of two Pelton wheels, each eighty-four inches in diameter, running at 300 revolutions per minute and rated at 4,000 horsepower. These wheels are controlled by Lombard automatic governors. The operating head is 970 feet and the supply conduit has a capacity of seventy-five cubic feet per second. Storage capacity of 20,900 acre-feet is provided. Each wheel is direct connected to a General Electric 2,250-kilowatt three-phase generator, operating at 4,000 volts. There are three transmission lines, one nineteen miles long and two of twenty-five miles each. Transmission is at three-phase and 45,000 volts. The plant runs twenty-four hours per day and the water supply as regulated by the storage reservoir is sufficient at all times. It was built about 1905. At Durango, twenty-five miles from Rockwood, there is a small steam plant of 720 horsepower, which can be used as an auxiliary. The power is used for lighting in the town, and for mining and milling purposes in the surrounding country. The price at which power is sold varies with the amount required. For the first 100 horsepower the rate is $3.25 per horsepower per month; for the next 400 horsepower, $2.25 per horsepower per month; for the next 500 horsepower, $1.75 per horsepower per month, and for all in excess of 1,000 horsepower, $1.00 per horsepower per month. For smaller quantities of power the rate is one and three-tenths cents per kilowatt-hour for the first 40,000 kilowatt-hours and one-half cent per kilowatt-hour for everything in excess of 40,000.

Yampa Drainage

STEAMBOAT MILLING COMPANY'S PLANT

The plant is located in Township 6 North, Range 84 West, 6th Principal Meridian, at the town of Steamboat Springs, in Routt county. This plant consists of a Leffel turbine thirty-two inches in diameter, operating at 150 revolutions per minute and rated at twenty-five horsepower. The wheel is not provided with a governor. The operating head is nineteen feet and the quantity of water consumed is about fifteen cubic feet per second. The water supply is derived from the Yampa river through a ditch and a flume. There is no storage. Power is used to drive a flour mill. The plant runs twelve hours per day and the water supply is sufficient at all seasons of the year. The plant was built about 1894.

CHAPTER X.

PUMPING FOR IRRIGATION

Within the past few years the practice of pumping water by mechanical means on to land to be irrigated has rapidly increased. In the earlier days of irrigation mechanical power was beyond the reach of the farmer in an irrigated country, and gravity supply led to the land by canals was the only possible means of irrigation.

In later years, however, the country has become covered with a network of electric power lines, and the development of the internal combustion engine has made it possible to generate power in either large or small quantities in isolated plants. People have gradually come to realize that the cost of operation of an irrigation system without reservoirs, with short canals, and in which the investment per acre is low, would compare very favorably with the cost of maintenance and interest charges against the heavy investment in great reservoirs and many miles of canals.

Although this mode of supplying water to land is comparatively new in Colorado, it has been the practice for many years in the southern states, particularly in Louisiana and Texas, where the fall of the streams is so slight that it is commercially impossible to lead water to the high land by gravity alone.

In Texas more than 300,000 acres of rice land are irrigated by pumping directly from the streams, and in Louisiana even more.

In Colorado pumping practice has been confined chiefly to the supply of water from wells rather than from surface streams. The practice is too new to permit of any generalization regarding it.

With a view to obtaining as much information as possible along this line, blank forms were prepared and supplied to the hydrographers of the State Engineer's office, with instructions to seek out pumping plants and fill out a form for each plant found. Many questions were asked on these forms which the owners themselves were unable to answer. However, the data obtained are valuable, even though not complete.

It cannot be pretended that every plant in the State has been visited or information concerning it obtained. However, every plant of which the hydrographers could learn in the time placed at their disposal was investigated, and as much information obtained as possible.

This information has been prepared in tabular form and is published in this chapter. It shows for each plant the location, the equipment, quantity of water pumped, height to which it is pumped, date of construction, and such cost data as are obtainable.

Although these cost data are somewhat meager, they are sufficient to show that in many instances water is supplied to the land for from $1.00 to $1.50 per acre-foot. This will compare very favorably with the cost of maintenance and the over-head charges of the ordinary gravity supply.

Of the eighty-five plants reported, all but nine are located in the Platte river drainage. Five are located in the Arkansas river drainage, and four in the Grand river drainage. All of those in the Grand river drainage area pump from a river or from a canal, while the most of the others pump from wells. The total area irrigated by these plants is 22,000 acres. The table includes one plant located in the State of Nebraska, and irrigating 1,600 acres.

The commercial success of this method of supplying water to land has been demonstrated, but one question remains unanswered and must remain so for some years to come. This is the quantity of underground water available. Most of the plants have been in operation for not more than two years—many of them for only one season. Whether they have drawn on the underground supply at a greater rate than this supply has been replenished is not yet determined.

As the number of plants increases and the acreage irrigated in this way grows, the time will come when the supply from some of the wells will be insufficient. By that time the quantity of water which can be counted on for continuous use will probably be pretty well determined.

At the present time there is a strong tendency to regard the underground water supply as absolutely inexhaustible. Some disappointments are sure to follow too great confidence in this method of supply.

The time will undoubtedly come when the courts will be called upon to adjudicate the rights of the various claimants to underground waters, as they now do in the case of surface waters, since it is sure to be found, with an increasing number of wells, that the supply of the older ones will be interfered with to some extent by the new.

The following table gives in concise form the more important parts of the information so far collected, without any attempt to generalize or to draw conclusions:

RIO GRANDE AT ALAMOSA, COLORADO, OCTOBER 8, 1911
Discharge, 14,000 Cubic Feet per Second

CHAPTER XI.

THE FLOOD OF OCTOBER 5, 1911, IN SOUTHWESTERN COLORADO

By B. S. Clayton
Hydrographer, State Engineer's Office

The highest flood in the memory of white man or Indian occurred on October 5, 1911, over the San Juan, Dolores, and upper Rio Grande drainage areas.

The San Juan river rises among the high peaks of the San Juan mountains and flows southward. It is a typical mountain stream until it reaches Canon Largo in New Mexico. Its principal tributaries, the Piedra, Pine, Florida, Animas and La Plata, are also mountain streams rising among the high peaks and flowing southward to the trunk stream in New Mexico.

The higher peaks of these mountains extend above timber line. The lower portions are timbered with pine, spruce and aspen.

During the last of September and first two days of October moderate rains fell, sufficient to saturate the ground. On the third of October these rains ceased but, commencing again on the fourth, increased on the fifth to severe storms. The records in Archuleta county showed precipitations on the fourth and fifth varying from 2.50 to 3.82 inches; in La Plata county from 3.40 to 3.52 inches, and in San Juan county from 2.59 to 8.05 inches. In normal years the precipitations of October 4 and 5 would have been stored as snow. The temperatures in the higher altitudes on these days appear to have been unusually high.

The most severe storm occurred in the region of Silverton, where 4.05 inches fell on the fifth. Six miles north, at Gladstone, 8.05 inches fell on the same day, and at Pagosa Springs, on the upper course of the San Juan, 3.67 inches were recorded.

The storm in the higher mountains must have been especially severe, as parties passing shortly afterwards over the higher passes reported groves of aspen of considerable size to have been completely beaten down by the storm. The fact that the earth was soaked by the earlier rains made possible an extremely heavy and sudden run-off from the rains of October 4 and 5. In fact, the ranchmen below had little warning, and when the streams first began to rise did not expect an unusual flood.

The highest water and greatest damage occurred along the San Juan river. Pagosa Springs and the ranches below suffered heavily. Many homes were washed away and ranches completely ruined. At Arboles the flood reached a point 17.2 feet above low water mark and was estimated at 30,000 cubic feet per second. Small buildings were swept away, the section house was badly damaged and immense trees were left stranded on top of freight cars on the siding. Mr. L. E. Smack, the State gauge reader at this point, says the flood presented an unusual sight, that the river was full of debris and large trees and timbers, and that the surface of the water appeared so much higher at the center than at the sides that it resembled the roof of a house. At Pagosa Junction a number of buildings were washed away and two lives were lost. Groves of cottonwood trees from one to two feet in diameter, between Pagosa Junction and Arboles, were left lying on the ground as though an immense steam roller had been passed over them. The Rio Grande railroad from Juanita to Arboles was almost totally destroyed. Train service to Durango was interrupted for a period of forty days. No eastern mail reached Durango for two weeks. Every bridge along the San Juan river was swept away.

The floods in the Piedra, Pine, Florida, La Plata, and Mancos rivers were all similar in character and exceeded previous records in magnitude.

The flood in the Piedra has been roughly estimated at 10,000 cubic feet per second. The State gauge was most certainly affected by back water caused by the high stage of the San Juan and hence not indicative of the true discharge. On the Pine river the flood did considerable damage to ranches and to county bridges. Data are not available on which to base a reliable estimate of the maximum discharge in the Pine. It was probably in excess of 10,000 cubic feet per second. No estimates were made on the maximum discharge of the Florida, La Plata or Mancos.

Much damage was done along the Dolores river. The maximum stage occurred at Dolores about 8:00 p. m. October 5. The gauge height reached 10.2 feet, giving a discharge of 10,000 cubic feet per second. The river broke across the railroad fill above and flooded the entire town to a depth of one to two feet. Higher up the stream, at Rico, more damage was done. Here a dozen buildings were washed away. Along the Dolores river the Rio Grande Southern railroad was so badly damaged that train service between Durango and Telluride was interrupted for three months.

At Placerville on the San Miguel river the maximum stage occurred between 4:00 and 5:00 p. m. October 5. The extreme gauge here was 5.5 feet and the maximum discharge was estimated at 2,000 cubic feet per second. The maximum velocity was obtained here by timing logs over a 200-foot course, and showed fourteen feet per second near the extreme stage of the flood.

Floods of lesser importance also occurred in the Uncompahgre, Gunnison and Grand rivers, but they did not exceed the ordinary spring rises.

The crest of the flood occurred at Pagosa Springs at 12:30 p. m. of the fifth; at Pagosa Junction at 5:00 p. m.; at Arboles about 7:00 p. m.; at Farmington, New Mexico, at 9:00 or 10:00 p. m. October 6; and at Shiprock, New Mexico, at 3:00 p. m. October 6.

The United States Geological Survey gauge showed an extreme stage at Shiprock, New Mexico, of twenty-two feet, which was eighteen to twenty feet above normal. The estimated discharge at this point was roughly 150,000 cubic feet per second. The distance between Pagosa Springs and Pagosa Junction is approximately twenty-five miles, which shows an advance of the crest of five and one-half miles per hour. From Pagosa Junction for a distance of thirteen miles, the advance was at the rate of six and one-half miles per hour.

Next to the San Juan, the most severe flood occurred in the Animas river. A great deal of damage was done to the ranches in the upper Animas valley above Durango. The Rio Grande railroad from Durango to Silverton was so badly damaged that traffic was delayed for nearly two months. No great damage occurred at Durango as the city proper is well above any possible flood. Most of the bridges in La Plata county were destroyed. An approach span to the railroad bridge above Main street was washed away. The transmission line of the San Juan Water & Power Company through the Animas canon was destroyed. The flood crest passed Tacoma where the power house of the San Juan Water & Power Company is located at 5:00 to 6:00 p. m. October 5 and reached Durango between 10:00 and 11:00 p. m. the same day, a distance of 20 miles.

The State gauge at Durango showed an extreme stage of 13.6 feet. The estimated discharge was 20,000 cubic feet per second.

While the flood in the Rio Grande valley did not equal that in the San Juan in proportions, it probably exceeded all previous records. The heavy rains over this drainage area extended from the head waters to El Paso, Texas, and fell on October 4 and 5. At the Wagon Wheel Gap lower station, at an elevation of 9,235 feet, the total for these two days was 2.65 inches. At the upper station, elevation 10,956 feet, the total was 3.62 inches.

The rainfall in the upper Conejos valley was exceedingly heavy. At Platora the total rainfall for the fourth and fifth was 3.30 inches. At Cumbres pass the total for the two days was 4.34.

At Wason the extreme stage of 7.0 feet occurred at 9:00 p. m. of October 5, showing a maximum discharge of 8,500 cubic feet per second. The flood reached the State bridge, six miles above Del Norte, about 9:00 or 10:00 p. m. of October 5. The extreme gauge was 6.8 feet. The river at this point overflowed the bank on both sides. An approximate estimate of the maximum discharge is 12,000 cubic feet per second.

The bridge over the South Fork of the Rio Grande, on which the State gauge was located, was completely washed away. This flood probably exceeded 5,000 cubic feet per second. There are no data from which to make a reliable estimate.

The crest reached Alamosa early in the morning of October 7. Here a dyke broke, allowing the waters to flood one-third of the town, but little damage resulted. About 2:00 a. m. on October 10 the flood reached the State bridge near Lobatos. The extreme gauge was 7.0 feet. A gauging was made on the afternoon of October 9 at 6.72 feet and showed 7,100 cubic feet per second. The estimated discharge at 7.0 feet is 7,500 cubic feet per second.

A comparison of the crests at Del Norte and the State bridge shows a difference of 4,500 cubic feet per second. The automatic gauge records at these points show the rise to be much slower and longer continued at the State bridge, indicating that the flood wave flattened out to a great extent when it struck the valley proper, due to the lower fall per mile over the section.

The bridge on the Conejos river at Jacob's ranch was completely destroyed. The gauge rod was fastened to this bridge. There are no data from which to make a reliable estimate of the flood. Six thousand cubic feet per second would probably be somewhere near the actual flow. Much damage was done to bridges, headgates, and ranches along the river.

A comparison of the times when the flood crest passed Wason and Del Norte shows beyond a doubt that the crest at Del Norte was due to the flood waters from the South Fork of the Rio Grande which empties in ten miles above.

The greatest damage from this flood occurred between South Fork and Del Norte. Along this stretch of river the water overflowed many ranches, destroyed most of the county bridges, and cut the railroad at several points. Train service between Alamosa and Creede was interrupted for a week.

The damage to the Rio Grande railroad lines in the San Juan, Dolores, and Rio Grande valleys has been roughly estimated at $500,000. It is very probable that the damage to roads, bridges and ranches exceeded this figure, making the total damage exceed one million dollars. Had the country been more thickly settled, especially in the San Juan valley, the damage and loss of life would have been far greater.

We must look far into the future for the time when reservoir storage will lessen the damage caused by such floods, but it may be noted with some satisfaction that such extreme floods will probably not occur more than once in fifty or a hundred years.

FLOOD IN ANIMAS RIVER NEAR DURANGO.
October, 1911.
Bridge on Silverton branch of Denver & Rio Grande Railroad.

PUMPING STATION.
Willcox Canal, Grand Valley Irrigation District.

PUMPING PLANT NEAR LA SALLE, COLORADO.
Three centrifugal pumps raise 3,335 gallons per minute from wells through a height of eight feet. Irrigate 200 acres.

DAILY PRECIPITATION FOR FIRST SIX DAYS OF OCTOBER, 1911

FOR STATIONS IN THE SAN JUAN AND DOLORES RIVER DRAINAGE

COLORADO

STATION	Elevation	WATER SHED	DAY OF THE MONTH 1	2	3	4	5	6	Total
Cascade	8,900	San Juan	1.09	0.04		0.19	2.40	0.13	3.85
Chromo	7,500	" "	0.45			0.50	2.00	0.01	2.96
Durango	6,534	" "	0.05	0.02		1.16	2.26		3.49
Eureka	10,000	" "	0.11	0.19			0.47		0.77
Gladstone	10,400	" "	1.62	T.		0.11	8.05	T.	9.78
Hesperus	8,113	La Plata				*	2.30	0.58	2.88
Mancos	6,960	San Juan	1.12	T.		0.08	1.54		2.74
Pagosa Springs	7,108	" "	0.33	0.01		0.15	3.67		4.16
Rico	8,824	Dolores	0.15	T.		0.37	1.71	0.15	2.38
Silverton (near)	9,400	San Juan	0.90	T.		0.20	4.05		5.15
Tacoma	7,300	" "							
Telluride	9,100	San Miguel	0.96	0.02		0.02	1.57	0.20	2.77
Terminal Dam	8,300	San Juan							
NEW MEXICO									
Aztec	5,590	San Juan	0.09			0.02	1.85	0.05	2.01
Bloomfield	5,500	" "	T.			0.24	1.39		1.63
Dulce	6,756	" "	0.28			0.20	1.75		2.23
Fruitland	4,800	" "				*	1.10		1.10

*Precipitation included in figure for next day.

DAILY PRECIPITATION FOR FIRST SIX DAYS OF OCTOBER, 1911

FOR STATIONS IN THE RIO GRANDE DRAINAGE, COLORADO

STATION	Elevation	WATER SHED	DAY OF THE MONTH 1	2	3	4	5	6	Total
Blanca	7,865	Rio Grande							
Cumbres	10,015	" "		0.30		3.08	1.26	0.49	5.13
Garnett	7,576	" "				0.74	0.14		0.88
Hermit	9,843	" "	0.60	0.04		T.	2.06		2.70
La Veta Pass	9,000	" "				0.59	1.42		2.01
Manassa	7,700	" "	0.15			1.28	0.15		1.58
Platora	9,675	" "	0.61	0.02		0.05	3.25	0.04	3.97
Saguache	7,740	" "					1.20	0.10	1.30
San Luis	7,794	" "	0.02			0.40	1.50	0.07	1.99
Wagon Wheel Gap	9,235	" "	0.17	T.		0.71	1.94		2.82

CHAPTER XII.

HYDROGRAPHIC DEPARTMENT

This is the most important department of the State Engineer's office. On it depends the collection of data which must serve as a basis for intelligent distribution of water to existing projects and as a guide to investors in new enterprises.

During the biennial period this department has rated 203 canals and has made 1,276 stream measurements. Each canal rating requires from three to five measurements at different gauge heights, and, in many instances, the rating of one canal with the time consumed in traveling to and fro requires more than a day.

Of the stream measurements made by the hydrographic department 1,037 have been made by the State hydrographers and 239 by hydrographers of the United States Geological Survey, for whom the State supplied transportation and paid traveling expenses. The work thus done by the Government hydrographers was on stations maintained by co-operative arrangement between the State and the Federal government.

In addition to this work, a considerable amount of hydrographic work has been done by Colorado hydrographers in Wyoming and in Kansas, for the collection of data to be used in the suits now pending between the State of Wyoming and the State of Colorado in one case, and certain Kansas parties and the State of Colorado in the other. In fact, the entire time of one State hydrographer for six months has been given to the collection of data to be used in the Kansas suit.

The number of stream measurements made by State hydrographers, therefore, considerably exceeds 2,000, or an average of one for every two days in the year for each of the six hydrographers. In view of the large number of days when field work was not possible, and the time necessarily consumed in traveling, this represents very energetic and efficient work on the part of the hydrographic force.

Prior to the session of the Eighteenth General Assembly the funds for this work were derived chiefly from the fees received in the State Engineer's office, as provided by Sections 3333 and 3334, Revised Statutes of Colorado, 1908, which are as follows:

"*3333. Fees deposited with state treasurer.* Sec. 169. At the end of each month the sum of the fees collected during the month, as provided for in section 1 of this act, shall be deposited with the state treasurer, with a complete statement showing the amounts thus received and the sources from which they are derived, and the said amounts shall be credited by the state treasurer to a fund which shall be known as a gauging fund.

3334. Application of fees. Sec. 170. The amount credited to the gauging fund created as hereinbefore provided shall be available for the payment of expenses and salaries required for work of gauging streams, rating ditches, making seepage measurements, or other work connected with the proper distribution of water or ascertaining desired information concerning the flow of water. Warrants for the payments of such salaries and expenses shall be issued by the auditor of state upon presentation of vouchers regularly drawn and approved by the state engineer."

The Eighteenth General Assembly, however, included in the general appropriation bill specific provisions for this department as follows:

	1911	1912	Total
Chief hydrographer, salary	$ 1,800	$ 1,800	$ 3,600
Six hydrographers, salaries at $125 per month each	5,100	9,000	14,100
Expenses of hydrographers	2,625	4,500	7,125
Total	$ 9,525	$15,300	$24,825

Included within the appropriation bill was the following provision concerning fees collected by the office:

"All fees and collections of the State Engineer's Office shall be turned into the State Treasury and the appropriation hereby made shall be paid therefrom. Any surplus remaining after paying the appropriation hereby made for said office shall be transferred to the General Fund. If the fees and collections of said office are not sufficient to cover said appropriation, the deficiency shall be supplied from the General Fund."

Since May 11, 1911, on which date the general appropriation bill became effective, all expenditures in the hydrographic department have been made from the appropriations above enumerated, except the payment of salaries of gauge readers.

An appropriation of $3,100 for the biennial period for "Incidental expenses, including repairs on equipment, and salaries of gauge readers and traveling expenses," was included in the general appropriation bill.

From this fund the gauge readers' salaries have been paid.

Prior to May 11, 1911, expenditures for the hydrographic department were made from the gauging fund created by the collection of fees in the State Engineer's office.

The expenditures for this department have been as follows:

Hydrographers' salaries	$18,906.17
Hydrographers' expenses	7,323.33
Salaries of gauge readers	3,540.34
Total	$29,769.84

Of the hydrographers' expenses, $399.70 has been expended for traveling expenses of the United States Geological Survey hydrographers, and the remainder for traveling expenses of the State hydrographers.

In addition to cash expenditures for traveling expenses the office has received through the courtesy of the railroads a large amount of free transportation.

In 1911, 127 trip passes were issued to the hydrographic force, fifty-nine for the use of State hydrographers and sixty-eight for the hydrographers of the United States Geological Survey.

In 1912 fifty-eight trip passes were issued on account of hydrographic work, twenty-seven to the State hydrographers and thirty-one to those of the Geological Survey.

In addition to these, six annual passes were issued in 1911, and eight in 1912, to the employees of the hydrographic department.

From January 1, 1912, to November 30, 1912, inclusive, the hydrographers traveled 38,637 miles on annual passes. Of this distance 35,937 miles was over roads where the average fare is 3.20 cents per mile, and 2,700 miles over roads where the regular rate is six cents per mile.

The use of these annual passes, therefore, represented $1,312 in railroad fare in 1912 alone.

Allowing an equal amount for distance traveled on annual passes in 1911, and taking into account the value of the trip passes issued during this period, this office has received for the use of the hydrographers $4,324 worth of transportation.

This, added to the actual cash outlay for travelling expenses, makes a total of nearly $12,000 in expenses which would have been necessary to carry on the work of this department for the biennial period, if the office had not received any free transportation.

Reckoning this transportation at its cash value, the cost of operating the department for the biennial period has been $34,093.84.

The number of gauging stations maintained has varied somewhat during the period, but has averaged about seventy.

If the entire cost of this department be charged to the maintenance of these gauging stations, the cost per station per annum has been $243.53.

As a matter of fact, an unknown, though considerable proportion of the total outlay is properly chargeable to the rating of canals, which work is required by law to be done by this office.

The only fund which has proven insufficient for its purpose is the Incidental Expense Fund, from which gauge readers' salaries are paid. Of the stations now maintained under the direction of this office, the gauge readers' salaries at fifteen are paid by interested parties other than the State. At a very few, we have been able to arrange for gauge readings without cost.

The gauge readers' salaries at the remaining stations aggregate $183 per month, the individual salaries varying from three to six dollars per month.

This is equivalent to $4,392 for the biennial period, if all these stations were maintained throughout the year. At some of them the weather conditions in the winter time are such that the observation of gauge heights is not worth while, and gauge readings are commonly discontinued at these stations during the cold weather.

This fact, together with the willingness of a few of the gauge readers to carry on their work for a month or two without compensation has enabled us to get through the biennial period with the $3,100 provided by the Incidental Expense Fund. In order to do this, however, we have been obliged to deny the office many desirable things in the way of supplies, bookbinding, etc.

It seems desirable that a special fund of not less than $4,000 should be appropriated for the payment of gauge readers' salaries, or that the Incidental Expense Fund should be increased to about $7,000.

AUTOMATIC GAUGES

There are thirty-one automatic recording water level gauges on stream gauging stations in this State, distributed as follows:

On Lake creek at Twin Lakes.

On Clear creek at outlet of Clear Creek reservoir near Granite.

On the Arkansas river at Granite, Salida, Canon City, Pueblo, Nepesta, La Junta, Ft. Lyon and Holly.

On the South Fork of the South Platte at Lake George.

On the South Platte river at South Platte and at Denver.

On the Rio Grande at Wason, Del Norte and Lobatos.

On the Saguache river near Saguache.

On the Grand river at Kremmling.

On the Cache la Poudre at the mouth of the canon.

On Boulder creek at Orodell.

On the Laramie at Glendevey and at Boswell's Ranch.

On the Animas river at Durango.

On the White river at Meeker.

In the Yampa river basin at the following stations:

On the Yampa river at Steamboat Springs.

On Willow creek at Ryan's ranch.

On Four Mile creek at Ranger station.

On Slater creek at Baxter's ranch.

On the Middle Fork of the Little Snake river and the South Fork of the Little Snake river, at Gardner's ranch.

On the Elk river at Hinman Park.

The equipment at nineteen of these stations is owned by the State; that at Twin Lakes is owned by The Twin Lakes Land and Water Company; that on Clear Creek, near Granite, by The Otero Irrigation District; those at La Junta and Holly, by The Arkansas Valley Ditch Association.

All those in the Yampa river basin, except the one on the Yampa at Steamboat Springs, are owned by the Elk River Irrigation and Construction Company.

That at Saguache is owned by The Stark-Hagadorn Irrigation Company. That on Boulder Creek, at Orodell, is owned by The Central Colorado Power Company.

All of these stations, however, are operated in co-operation with the State, the measurements being made by State hydrographers, and the results being collated and analyzed in the State Engineer's office.

An automatic gauge owned by the State, and formerly maintained on the Dolores river at Dolores, was destroyed by the flood in October of 1911.

Of the automatic gauges above listed, the following have been installed since December 1, 1910:

On the Arkansas river at La Junta, Ft. Lyon and Holly.

On the Laramie river at Boswell's ranch.

On Willow creek at Ryan's ranch.

On Four Mile creek at Ranger station.

On Slater creek at Baxter's ranch.

On Middle Fork and South Fork of Little Snake river, at Gardner's ranch.

On Elk river at Hinman Park.

CABLE STATIONS

At twelve gauging stations the streams have been spanned by cables carrying suspended cars from which measurements can be made at high water. Such cable spans have been constructed at the following stations:

On the Arkansas river at Granite, at Canon City and at Ft. Lyon.

On the South Platte river at South Platte.

On Boulder creek at Orodell.

On St. Vrain creek at Lyons.

On the Cache la Poudre at the mouth of the canon.

On the Animas river at Durango.

On the San Juan at Arboles.

On the Grand at Kremmling.

On the Yampa at Maybell.

On the Elk river at Hinman Park.

The cable equipment on Boulder creek at Orodell is the property of The Central Colorado Power Company. That on the Elk river at Hinman Park belongs to the Elk River Irrigation and Construction Company. Those on the Grand river at Kremmling and on the South Platte river at South Platte belong to the United States Geological Survey. The others are the property of the State.

Of these cable stations, the following have been installed since December 1, 1910:

On the Arkansas river at Ft. Lyon.

On the Animas river at Durango.

On the San Juan river at Arboles.

On the Yampa river at Maybell.

On the Elk river at Hinman Park.

The installation on the San Juan at Arboles replaced a cable station destroyed by the flood of October, 1911.

In the following chapter will be found a description in detail of each of these gauging stations, together with its equipment, cost of operation, measurements made during the biennial period, and a tabular statement of the stream discharge for each day, the monthly and annual means, maxima and minima, the total run-off in acre-feet, the run-off in acre-feet per square mile, and the run-off expressed as depth in inches over the entire drainage area above the station.

Although the number of stream gauging stations in Colorado has been greatly increased during the past four years, it is still far from being sufficient. Comparing the number of stations, the records of which are accessible to the public, with the area of the State, we find one gauging station for about 1,500 square miles of area.

By way of comparison with what is done in other parts of the world, it may be noted that in the drainage basin of the Seine, with an area of 30,327 square miles, the French government maintains 120 gauging stations, or one for each 253 square miles. Even this number is not considered sufficient by the French authorities, and it is now being increased.

If Colorado would maintain stream gauging stations on the same scale as is found necessary in other parts of the world, there would be from 450 to 500 stations in the State. The expense per station would decrease quite rapidly with the increase in number, since the present hydrographic force could undoubtedly care for from two to three times the present number of stations, with only a moderate increase in expenses, and with no increase in salary account. The principal cost would be that of installation, which varies from twenty-five to two hundred dollars per station, depending upon the character and amount of equipment found necessary.

AVAILABLE RUN-OFF DATA

A moderate amount of data concerning run-off from mountain areas has been accumulated, and, if it be used intelligently, there is no reason why one should go very far astray in estimating available water supply from mountain drainage.

Within the past few years a considerable number of irrigation projects proposing to utilize the flood run-off from plains areas have been brought to the attention of the public. A few of these have reached the point of completing their construction work, and have then failed miserably for lack of water.

It is a matter of common observation that some arroyos, and other water courses which do not originate at high altitudes and which receive no water whatever from melting snows, discharge large quantities of water for short periods immediately following torrential storms.

In the attempt to conserve and utilize this water, some of the projects referred to have been built. In planning them, however, the water supply has been wofully over-estimated. There are no data from which the run-off from these plains areas can be determined.

The method in common and successful use for perennial streams is not applicable to these dry water-courses. It is almost impossible for a hydrographer to reach a station on one of these streams in time to make a measurement of a flood discharge, even if the station were equipped.

The only practicable way of accumulating data on stations of this kind seems to be to have some one near at hand, who is sufficiently well trained in hydrographic methods and in the science of hydraulics, to make whatever measurements may be possible while the floods are in progress.

This work cannot be done by the farmer or the chance resident near a gauging station, as gauge readings are made. It will be necessary to train some one whose residence or place of business is near a suitable station, and to pay that person a reasonable compensation to make systematic and thorough observations and measurements of flood discharges at a given station.

The cost might be in the neighborhood of a thousand dollars a year for one station, but if by that means some definite and reliable data as to the run-off from plains areas can be obtained, the cost would be justified.

There is no doubt that the plains areas of eastern Colorado will annually supply water sufficient to irrigate an important acreage, but we must have definite information in order to avoid the expenditure of more money for reservoirs and canals than the water obtainable will justify.

We might with advantage begin with one properly equipped and managed station in the Platte river valley, and one in the Arkansas valley. After they had been operated for two years, there would be a basis for determining whether the work could be extended to advantage.

PRECIPITATION DATA

The State of Colorado has done very little toward the determination of the monthly and annual precipitation at different points in the State. Such information as we have is from the records of the United States Weather Bureau.

This organization, although most efficient and operated according to the most modern scientific methods, is obliged to cover the entire United States with a very moderate expenditure. As a consequence, the number of points of observation in Colorado is quite small when compared with the importance of all matters relating to water supply in this part of the country.

The Monthly Weather Review, an official publication of the United States Weather Bureau, gives a list of 156 rainfall stations in this State. Of these, forty-five are in the Platte river drainage basin, thirty-nine in the Arkansas, two in the drainage area of the Cimarron, ten in the Rio Grande, and sixty-two in the Colorado river drainage. These numbers total 158, but two of the stations are counted twice. That at Corona is common to the

South Platte and the Colorado rivers, while the station at Marshall Pass is common to the Arkansas and the Colorado.

The area of the State of Colorado is 103,948 square miles. We thus have an average of one rainfall station to each 666 square miles, or, say one to an area of twenty-six miles square. This number might be considered adequate if the conditions upon which precipitation depends were even approximately uniform throughout the State, which, however, they are not.

By way of comparison, we may note the distribution of precipitation stations in some other parts of the world. The French government maintains 423 precipitation stations in the drainage area of the Seine, an average of one to each seventy-two square miles. This is as one for each two townships, as compared with one for each eighteen townships in Colorado.

In the valley of the Rhone there is a precipitation station for each ninety-six square miles.

In Switzerland there is one for each forty-four square miles.

The entire area of France is less than twice that of Colorado, and if we would maintain precipitation records comparable with those abroad, we must have not less than 1,400 stations in this State. Even the very large number established in the basin of the Seine is deemed insufficient by the engineers charged with the improvement and maintenance of the water-ways in that region, and in the most elaborate and exhaustive report on the flood of January, 1910, prepared by the government engineers and recently issued by the French government, a substantial increase in the number of these stations is proposed.

The question is frequently asked: "What is the ratio of run-off to rainfall?" in this or that drainage area. This question is not answerable for any drainage area in the State of Colorado, for the obvious reason that we do not know how much water falls on any such drainage area. Meager and unsatisfactory as our run-off records may be, we know more about the total run-off than about the total precipitation.

The State should provide funds to equip and maintain a large number of precipitation stations. The equipment is simple, consisting only of a standard rain gauge, costing perhaps five or six dollars. It is not difficult to find people willing to make the necessary observations and record the results for a nominal sum, say, three to five dollars per month.

It is probable that the United States Weather Bureau would be willing to supply the necessary printed matter and franked envelopes for the sake of increasing the volume of its precipitation records, although it is not willing, or cannot afford, to equip very many stations in addition to those which it already maintains.

Furthermore, the Weather Bureau has no funds from which to pay gauge readers and is compelled to rely upon voluntary observers. These are not always easy to find.

EVAPORATION

In the matter of evaporation measurements, almost nothing has been done. Observations have been desultory and scattered. Diligent search has failed to reveal more than one record extending through an entire year. Such observations as have been made have been without uniformity of method or procedure, and are hardly comparable.

So far from being able to know the comparative evaporation in the mountains and on the plains, we are not even in a position to state definitely the average annual evaporation at any one place in Colorado. This is without doubt a task which should be undertaken by the State hydrographic service, but it is a formidable one for several reasons.

Evaporation stations depend for their value upon measurements which must be made with great precision and at frequent intervals. In addition to direct measurements of the loss of water, collateral observations of temperature, barometric pressure, wind direction and velocity, and hygrometric conditions must be made at regular and frequent intervals. Without these, measurements of loss by evaporation are mere isolated facts upon which it will be impossible to base any generalization whatever.

All this means the expenditure of a considerable sum for the equipment of a station and the attendance of a skilled observer. The work cannot be entrusted to such observers as happen to be resident near the station, as is done with a fair degree of satisfaction with stream gauging stations.

The necessary equipment is practically that of a standard Weather Bureau station, and the attendant must be some one learned and skilled in meteorological methods. The State should equip and provide for at least one such station at the earliest possible moment. It takes time to accumulate physical data, and the demand for such facts must be anticipated.

At first thought it may seem that evaporation is only of academic interest. It has, however, a practical importance in the distribution of water. If a reservoir is located on the channel of a natural stream, and if it is not permitted to store water, the water commissioner simply takes care to see that the reading of the reservoir gauge remains constant. By this method the stream continually makes up the evaporation loss from the reservoir surface, whereas the reservoir should be required to stand this loss.

That this is not a trivial matter will be evident at once from an illustration. I have in mind two reservoirs located on a natural stream, whose aggregate high water areas exceed 4,000 acres. If the annual evaporation from the water surface is only four feet (it is probably more), the annual loss exceeds 16,000 acre-feet, and this loss falls not on the reservoirs, but on appropriators below.

It is impossible to take account of the evaporation from day to day, since it amounts to only one or two-tenths of an inch, and differences of this magnitude are masked by the disturbing action of the wind on the

water surface. If, however, the evaporation from month to month were known with accuracy, water could be turned out of these reservoirs at frequent intervals so as to compensate for the losses.

I have not sufficient data to permit an estimate of the total loss to the streams by evaporation from the surface of channel reservoirs in the State. However, this loss is certainly very large, and it falls at times very heavily on ditch appropriations of early date.

With the information now at hand any attempt to compensate the streams for the evaporation loss by the withdrawal of water from the reservoirs would be based upon arbitrary action, and would, perhaps, be frowned upon by the courts if the matter came to their attention. If, however, we had accurate knowledge of the facts, courts and reservoir owners alike would probably take a very different view of the question.

UNDERGROUND WATERS

This chapter would not be complete without a mention of underground waters. The hydrographic department has, however, done no work on this subject and has no data to offer. More than this, it has not at this time any suggestions as to how to proceed to obtain data. That the subject is of great interest and importance is certain, but methods for its study are not well developed, and it is not yet clear what can be or what should be done.

In another chapter will be found an account of some of the practical results obtained in irrigation from underground water sources. These, however, are at the present time merely disconnected facts from which no conclusions can be drawn.

SEEPAGE MEASUREMENTS

The entire absence of so-called "seepage measurements" in this report will probably be noted. The omission of this class of work has been deliberate and the result of careful study. Not only are the direct results of the measurements themselves open to grave question, but the elaborate conclusions which have been drawn from them are seriously in error, and have given rise to many false impressions.

The theory of these seepage measurements is based upon several assumptions. These are:

First. An absolutely permanent condition of the stream and its tributaries during the progress of the measurements.

Second. The possibility of differentiating with certainty between the inflow due to surface run-off and that due to the ground water inflow.

Third. That the ground water inflow is due entirely to the application of water to irrigated lands.

Fourth. An assumed accuracy of the measurements themselves, which is not justified.

Fifth. The most violent of all assumptions, viz: That the conditions found to prevail at the time of the measurements prevail throughout the year.

None of these assumptions are justified. The river flow is not permanent. The distinction between the surface run-off and the ground water inflow is not well marked, and cannot be accurately defined, and even if it were there is no means of knowing what proportion of the ground water inflow is due to the application of irrigation water. The differences noted in the seepage tables as gains or losses in a certain distance are frequently less than the probable errors of the measurements themselves. And, lastly, there is no justification for assuming that the conditions prevailing in the fall, when the seepage measurements have generally been made, are those of the entire year.

On these grounds it has been determined that the seepage measurements are not worth what they cost, that they show nothing that is not brought out to better advantage by the maintenance of permanent stations, and that they lead to erroneous conclusions in the minds of most people as to the quantity of irrigation water which returns to the streams.

SUMMARY

To sum up, this chapter discusses the following subjects:

Surface Run-off.

Precipitation.

Evaporation.

Underground waters.

Seepage measurements.

Under the first heading the results and costs of stream measurement, chiefly from the mountain areas, have been shown, and the necessity for data relative to run-off from the plains areas has been pointed out.

Under the second heading it has been shown that our knowledge of precipitation in the State is absolutely insufficient, and suggestions for extending the service in this direction have been made.

Under the third heading the importance of an accurate knowledge of evaporation in the practical distribution of water has been indicated, and a suggestion made as to a procedure for increasing our knowledge on this point.

Under the fourth heading I could only indicate our entire lack of information on the subject of underground waters in Colorado.

Under the last heading my reasons for abandoning what has heretofore been common practice in the hydrographic department are given, and the serious errors into which the practice has led us are indicated.

CHAPTER XIII.

HYDROGRAPHIC DATA

The following pages contain descriptions of gauging stations, records of discharge measurements, and tables of stream discharges at the various stations during the biennial period. These are classified according to the main drainage areas in which the stations are located, and the drainage areas are arranged alphabetically.

Included in this report is a drainage map of the State of Colorado, on which are located all stream gauging and precipitation stations of which we have been able to obtain any record. The stations shown on this map are not only those now maintained, but, in addition, those which have been maintained at some time in the past.

For all of the stations shown on the map, both precipitation and stream gauging, the records are in the files of the State Engineer's office. They are not in published form, and, therefore, not available for distribution, but are accessible to any one who may call at the office to examine or copy them.

These records, if published, will make a book of about 1,000 pages of the size of this report. It is believed that they are sufficiently in demand so that they could be sold at a price sufficient to pay the cost of publication, if funds were available for that purpose.

The law providing for the publication of reports by the various departments does not permit the expenditure of funds appropriated for this purpose for the publication of earlier records.

Arkansas River Drainage

ARKANSAS RIVER AT GRANITE

The automatic gauge at this station is located about one-fourth mile above the Denver & Rio Grande railroad station at Granite.

A cable from which the high water measurements are made is located one-fourth mile above the gauge.

The section is permanent and results are good.

Lake creek empties into the Arkansas river about two miles above station and Clear creek two miles below.

During 1911 and 1912 the placer mine ditch, which diverted water from Lake creek and discharged below the gauging station, was not in operation so that flow has only been affected by the Twin Lakes and Sugar Loaf reservoirs and small ditches above.

The observer is George Morrison, whose salary is $3.00 per month.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT GRANITE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 27*	Grieve & Clayton	38	2.08	2.90	79
Feb. 25*	Thos. Grieve, Jr.	32	2.02	2.90	65
Mar. 24	Thos. Grieve, Jr.	58	1.66	1.42	96
Apr. 19	Thos. Grieve, Jr.	70	2.10	1.67	148
May 11	Thos. Grieve, Jr.	188	4.51	3.00	848
June 20	C. C. Hezmalhalch	251	5.60	3.60	1,403
July 24	Thos. Grieve, Jr.	154	4.32	2.75	667
Aug. 10	Bunger & Hezmalhalch	130	3.06	2.30	399
Sept. 12	M. E. Bunger	100	2.07	1.85	206
Oct. 11	M. E. Bunger	96	2.07	1.84	199
Dec. 12*	M. E. Bunger	30	1.50	1.40	45
1912 Feb. 3*	C. C. Hezmalhalch	36	1.24	....	44
Mar. 12*	Thos. Grieve, Jr.	42	1.48	1.70	62
Apr. 8	C. C. Hezmalhalch	50	2.36	1.58	117
May 29	C. C. Hezmalhalch	232	5.59	3.51	1,296
June 7	A. A. Weiland	294	6.93	4.10	2,034
June 21	Thos. Grieve, Jr.	154	3.83	2.68	590
June 25	Thos. Grieve, Jr.	207	5.12	3.22	1,060
July 23	B. S. Clayton	228	5.96	3.52	1,360
Sept. 3	B. S. Clayton	89	2.21	1.80	197
Oct. 15	B. S. Clayton	81	1.84	1.62	149
Nov. 21	Thos. Grieve, Jr.	56	1.77	1.45	100

*Ice conditions.

DISCHARGE OF ARKANSAS RIVER AT GRANITE FOR 1911

Drainage Area, 425 Square Miles. Altitude, 8,930 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	
1	70	75	75	70	100	470	1,140	995	740	255	215	135	70	
2	70	75	75	70	110	440	1,240	1,040	665	255	180	135	70	
3	85	75	75	70	110	390	1,240	1,290	665	255	165	110	70	
4	70	75	75	75	72	560	1,290	1,240	740	235	150	120	60	
5	55	75	75	75	80	560	1,450	1,340	630	215	255	120	60	
6	78	75	75	85	80	700	1,560	950	530	198	255	120	60	
7	78	75	75	85	80	740	1,560	740	500	180	198	110	60	
8	85	75	75	85	90	820	1,670	950	255	180	198	120	45	
9	85	75	75	95	90	1,040	1,730	1,090	318	198	215	110	45	
10	85	75	75	95	100	1,040	1,670	1,090	365	198	215	135	45	
11	85	75	75	95	100	780	1,560	950	470	198	215	120	45	
12	85	75	70	100	100	630	1,615	820	390	215	180	110	45	
13	85	75	70	100	80	595	1,450	780	470	275	198	180	45	
14	85	75	70	100	90	630	1,450	740	440	275	235	165	45	
15	85	75	70	100	135	700	1,670	700	390	295	255	135	45	
16	85	75	70	90	120	630	1,505	665	318	275	235	150	45	
17	85	80	70	100	135	780	1,450	665	340	318	215	135	45	
18	80	80	70	80	135	740	1,395	740	318	275	215	135	45	
19	80	80	70	80	180	780	1,395	740	595	215	215	135	45	
20	80	80	65	90	180	630	1,450	700	665	235	215	135	45	
21	80	80	65	100	215	560	1,450	700	740	235	235	120	45	
22	80	80	65	90	215	500	1,450	665	740	215	235	110	45	
23	80	80	65	90	235	595	1,395	630	560	215	215	100	45	
24	80	80	65	100	215	630	1,240	630	560	198	198	100	45	
25	80	80	65	90	215	700	1,140	530	780	180	165	90	45	
26	80	80	65	72	180	860	1,090	530	390	165	150	90	45	
27	80	80	65	65	295	860	1,090	560	595	150	150	90	45	
28	80	80	65	72	340	950	1,240	595	318	135	135	80	45	
29	80	80	....	72	440	950	1,190	560	340	150	135	80	45	
30	80	80	....	80	470	995	1,040	530	390	180	135	80	45	
31	80	80	....	90	....	950	....	500	255	....	135	....	45	
Total	2,475	2,400	1,970	2,661	4,987	22,205	41,815	24,655	15,472	6,568	6,112	3,555	1,530	Year 1911
Mean	80	77	70	86	166	716	1,294	795	499	219	197	118	49	367
Maximum	85	80	75	100	470	1,040	1,730	1,340	780	318	255	180	70	1,730
Minimum	55	75	65	65	72	390	1,040	500	255	135	135	80	45	45
Run-off per square mile	0.188	0.181	0.165	0.202	0.391	1.684	3.045	1.871	1.174	0.515	0.464	0.278	0.115	0.864
Run-off, depth, inches	0.217	0.209	0.172	0.233	0.436	1.941	3.398	2.157	1.353	0.575	0.535	0.310	0.133	11.765
Run-off, acre-feet	4,909	4,760	3,907	5,278	9,892	44,043	82,940	48,902	30,688	13,028	12,123	7,051	3,035	265,696
Acre-feet per square mile	11.55	11.20	9.19	12.42	23.28	103.63	195.15	115.06	72.21	30.66	28.53	16.59	7.14	625.05

NOTE.—Ice conditions Jan. 1-Mar. 11, Nov. 25-Dec. 31, 1911 and Dec., 1910. Discharge estimated from measurements.

DISCHARGE OF ARKANSAS RIVER AT GRANITE FOR 1912

Drainage Area, 425 Square Miles. Altitude, 8,930 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	45	44	55	80	235	1,505	1,140	530	210	140	130	....	
2	45	44	55	80	255	1,395	1,040	470	195	140	140	....	
3	48	44	55	110	255	1,450	1,040	415	195	140	130	....	
4	43	44	62	150	215	1,615	1,040	390	180	130	120	....	
5	48	44	62	165	180	1,790	995	318	180	130	120	....	
6	46	44	62	150	165	2,030	905	318	180	130	120	....	
7	50	44	62	120	255	2,030	950	295	180	130	130	....	
8	45	44	62	135	560	1,910	1,140	340	165	130	130	....	
9	46	44	62	150	560	2,030	1,190	340	165	130	130	....	
10	46	44	62	150	595	1,560	1,240	318	165	130	130	....	
11	46	44	62	120	665	1,790	1,040	295	165	130	120	....	
12	44	44	62	120	630	1,670	1,090	275	140	140	120	....	
13	43	50	62	100	595	1,560	1,090	275	140	130	112	....	
14	44	50	62	100	390	1,910	1,190	295	140	130	112	....	
15	44	50	65	100	235	1,340	995	365	152	140	120	....	
16	46	50	65	110	215	1,140	780	415	165	152	120	....	
17	48	50	72	120	255	860	780	440	165	165	112	....	
18	48	50	72	120	318	780	820	365	165	180	105	....	
19	45	50	72	120	365	780	780	275	152	140	105	....	
20	44	50	80	120	470	630	780	390	165	130	105	....	
21	48	50	80	100	780	630	950	500	195	120	112	....	
22	45	50	80	90	1,090	950	1,240	500	225	120	112	....	
23	44	50	72	100	1,240	1,140	1,450	560	165	120	112	....	
24	43	55	72	110	1,240	1,240	1,240	560	165	120	98	....	
25	45	55	80	150	1,340	1,040	1,240	530	152	120	90	....	
26	48	55	100	135	1,450	950	1,240	530	165	120	98	....	
27	46	55	100	135	1,395	1,040	1,240	530	140	120	105	....	
28	45	55	110	150	1,290	1,090	1,240	500	140	120	120	....	
29	45	55	100	165	1,340	1,190	1,240	440	130	120	130	....	
30	45	....	110	198	1,560	1,240	1,190	240	130	130	112	....	
31	45	....	80	....	1,670	....	740	225	....	130	....	....	
Total	1,413	1,408	2,257	3,753	21,808	40,285	33,035	12,239	4,971	4,107	3,500	....	Period
Mean	46	48	73	125	703	1,343	1,066	395	166	132	117	....	384
Maximum	50	55	110	198	1,670	2,030	1,450	530	225	180	140	....	2,030
Minimum	43	44	55	80	165	630	740	225	130	120	90	....	43
Run-off per square mile	0.108	0.113	0.172	0.294	1.654	3.160	2.508	0.929	0.391	0.311	0.275	....	0.904
Run-off, depth, inches	0.125	0.122	0.198	0.328	1.907	3.526	2.892	1.071	0.436	0.358	0.307	....	11.270
Run-off, acre-feet	2,803	2,793	4,477	7,444	43,256	79,905	65,525	24,276	9,860	8,147	6,943	....	255,429
Acre-feet per square mile	6.59	6.57	10.53	17.52	101.78	188.01	154.17	57.12	23.20	19.17	16.34	....	601.00

NOTE.—Ice conditions Jan. 1-Mar. 18. Discharge estimated from measurements.

ARKANSAS RIVER AT SALIDA

This station is located about 400 feet below the concrete bridge at Salida.
The equipment consists of an automatic gauge and sloping staff gauge.
Measurements during high water are made from the concrete bridge. The section is fairly permanent.
The observer at this station is Howard Sneddon, whose salary is $3.00 per month.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT SALIDA

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gaug Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 27	Thos. Grieve, Jr.	91	2.34	0.56	213
Jan. 28	B. S. Clayton	94	2.22	0.58	209
Feb. 25	Thos. Grieve, Jr.	92	2.46	0.62	226
Mar. 24	Thos. Grieve, Jr.	98	2.70	0.79	265
Apr. 20	Thos. Grieve, Jr.	108	2.68	0.80	289
May 12	Thos. Grieve, Jr.	211	4.84	2.55	1,021
June 22	C. C. Hesmalhalch	430	6.97	4.79	2,993
Aug. 11	Bunger & Hesmalhalch	183	4.32	1.90	790
Sept. 13	M. E. Bunger	142	3.27	1.32	464
Oct. 12	M. E. Bunger	174	3.77	1.70	657
Dec. 16	M. E. Bunger	93	2.50	0.55	233
1912 Jan. 17	C. C. Hesmalhalch	92	2.46	0.60	225
Feb. 5	C. C. Hesmalhalch	89	2.24	0.52	200
Mar. 12	Thos. Grieve, Jr.	84	2.50	0.50	210
Apr. 11	C. C. Hesmalhalch	110	2.61	0.85	287
June 20	Thos. Grieve, Jr.	227	5.11	2.72	1,160
July 24	B. S. Clayton	299	6.05	3.59	1,810
Sept. 14	B. S. Clayton	132	3.64	1.26	480
Oct. 16	B. S. Clayton	115	3.13	0.99	360

DISCHARGE OF ARKANSAS RIVER AT SALIDA FOR 1911

Drainage Area, 1,160 Square Miles. Altitude, 7,038 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	225	175	215	195	228	540	1,680	1,815	1,110	758	555	395	280	
2	225	168	205	195	240	500	1,860	2,860	1,175	758	635	395	295	
3	225	168	205	205	240	440	1,905	3,010	1,040	695	605	435	265	
4	238	168	402	205	252	655	1,860	3,010	1,130	665	605	455	280	
5	205	160	420	215	240	680	2,085	3,110	1,000	665	888	415	280	
6	205	175	240	215	228	830	2,360	2,810	960	555	1,110	340	310	
7	215	185	240	205	215	1,000	2,360	1,995	970	455	790	358	295	
8	225	205	240	205	215	1,070	2,410	1,860	790	435	758	395	265	
9	225	205	240	215	215	1,210	2,660	2,040	680	435	758	395	250	
10	225	215	228	265	228	1,280	2,410	2,040	690	435	758	415	265	
11	225	215	215	252	215	1,210	2,360	1,950	790	455	725	415	238	
12	215	195	215	215	215	1,000	2,460	2,040	758	455	665	310	215	
13	205	195	215	215	205	940	2,460	1,995	790	530	605	340	225	
14	195	195	215	205	195	912	2,410	1,950	758	580	605	375	215	
15	185	195	215	215	195	1,000	2,710	1,770	758	580	665	358	205	
16	195	205	215	215	205	912	2,710	1,600	695	580	605	358	225	
17	195	205	215	240	228	970	2,510	1,520	695	555	635	340	215	
18	185	195	215	215	228	1,000	2,510	1,520	695	505	580	340	205	
19	215	195	205	215	252	1,035	2,410	1,725	920	435	555	395	225	
20	250	195	195	215	278	940	2,510	1,640	1,110	455	555	375	225	
21	238	205	195	228	278	830	2,610	1,210	1,230	455	555	375	205	
22	225	195	185	240	290	805	2,810	1,480	1,315	415	555	340	195	
23	215	185	175	228	305	880	2,610	1,440	1,110	415	555	310	225	
24	225	195	185	228	320	912	2,410	1,400	1,272	455	555	325	225	
25	238	195	205	240	320	1,070	2,360	1,320	1,358	455	555	310	215	
26	225	195	195	215	305	1,210	2,130	1,400	995	435	555	395	205	
27	225	205	195	205	350	1,210	2,040	1,245	1,070	415	555	340	205	
28	215	215	195	215	402	1,320	2,175	1,245	790	415	555	280	225	
29	205	215	....	205	460	1,440	2,085	1,175	822	375	415	265	225	
30	195	215	....	215	500	1,520	1,860	1,140	888	455	395	295	225	
31	195	215	....	215	....	1,520	....	980	790	....	435	....	215	
Total	6,679	6,049	6,285	6,756	8,047	30,791	69,730	56,295	29,154	15,166	19,342	10,839	7,343	Year 1911
Mean	215	195	224	218	268	993	2,324	1,816	940	506	624	361	237	728
Maximum	250	215	420	265	500	1,520	2,810	3,010	1,358	758	1,110	455	295	3,010
Minimum	185	160	175	195	195	440	1,680	980	680	375	395	265	195	160
Run-off per square mile	0.186	0.168	0.193	0.188	0.231	0.856	2.004	1.565	0.810	0.436	0.538	0.311	0.204	0.628
Run-off depth, inches	0.215	0.194	0.201	0.217	0.258	0.987	2.235	1.805	0.934	0.487	0.621	0.347	0.235	8.523
Run-off, acre-feet	13,248	11,998	12,466	13,404	15,961	61,074	138,309	111,661	57,827	30,082	38,365	21,499	14,565	527,208
Acre-feet per square mile	11.42	10.34	10.72	11.55	13.75	52.65	119.21	96.26	49.83	25.97	33.08	18.54	12.55	454.50

NOTE.—Channel open all year.

DISCHARGE OF ARKANSAS RIVER AT SALIDA FOR 1912

Drainage Area, 1,160 Square Miles. Altitude, 7,038 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	200	200	210	192	295	2,320	2,370	1,120	510	390	370	....	
2	200	210	210	192	335	2,420	2,125	1,000	470	390	350	....	
3	200	220	200	210	320	2,628	2,080	860	470	370	350	....	
4	200	200	185	245	282	2,950	1,990	810	455	370	410	....	
5	210	210	192	258	270	3,172	1,682	700	435	390	430	....	
6	220	200	200	270	282	3,288	1,520	630	435	390	410	....	
7	232	200	210	245	295	3,345	1,560	610	435	390	430	....	
8	210	220	200	258	480	3,345	1,725	590	435	390	450	....	
9	178	210	200	282	658	3,172	1,990	950	420	370	430	....	
10	210	220	210	295	635	2,628	2,080	815	420	370	430	....	
11	185	232	210	258	658	2,080	1,600	545	420	410	410	....	
12	185	210	200	270	658	2,035	1,855	525	405	390	350	....	
13	210	192	210	232	585	2,080	1,945	485	370	390	330	....	
14	220	200	200	210	585	2,170	2,220	505	390	390	330	....	
15	220	200	200	210	440	2,125	2,125	620	430	390	330	....	
16	232	192	200	210	385	1,682	1,370	935	450	370	350	....	
17	220	192	200	232	402	1,405	1,232	970	450	370	330	....	
18	210	192	192	232	500	1,200	1,600	970	450	370	315	....	
19	210	185	200	245	562	1,265	1,768	830	450	370	315	....	
20	210	178	210	245	705	1,168	1,725	540	450	350	315	....	
21	200	178	192	210	950	1,265	1,682	750	450	350	315	....	
22	200	185	200	200	1,442	1,480	2,080	805	495	330	315	....	
23	200	200	200	200	1,600	1,855	2,270	865	495	330	315	....	
24	200	200	200	220	1,682	2,170	1,900	865	472	330	300	....	
25	220	185	200	258	1,725	1,945	1,900	840	450	330	300	....	
26	220	185	200	258	2,270	1,990	1,900	840	450	350	285	....	
27	220	192	210	258	2,170	1,900	2,000	840	430	330	270	....	
28	210	200	220	258	1,990	2,370	2,140	820	410	330	285	....	
29	200	185	232	270	2,035	2,470	2,220	820	410	330	285	....	
30	200	....	245	282	2,420	2,575	2,290	665	390	350	285	....	
31	200	....	210	....	2,470	....	1,750	530	....	390	....	....	
Total	6,432	5,773	6,348	7,205	30,086	66,498	58,694	23,650	13,202	11,370	10,390	....	Period
Mean	207	199	205	240	971	2,217	1,893	763	440	367	346	....	715
Maximum	232	232	245	295	2,470	3,345	2,370	1,120	510	410	450	....	3,345
Minimum	178	178	185	192	270	1,168	1,232	485	370	330	270	....	178
Run-off per square mile	0.178	0.172	0.177	0.207	0.837	1.911	1.632	0.658	0.379	0.316	0.298	....	0.617
Run-off, depth, inches	0.205	0.186	0.204	0.231	0.965	2.132	1.881	0.759	0.423	0.364	0.332	....	7.682
Run-off, acre-feet	12,578	11,451	12,591	14,291	59,676	131,900	116,420	46,910	26,186	22,552	20,609	....	475,344
Acre-feet per square mile	11.00	9.87	10.85	12.32	51.44	113.71	100.36	40.44	22.57	19.44	17.77	....	409.77

NOTE.—Channel open all year.

ARKANSAS RIVER AT CANON CITY

This station is located at the Hot Springs hotel about one mile above Canon City.

The equipment consists of two gauges of the chain type, an automatic gauge and cable with car.

During October, 1911, a flood down Grape creek, which enters the Arkansas about one-half mile above, filled in the channel with boulders and gravel so that the automatic gauge was in use only during high water. It was also necessary to establish another gauge on the north bank of the river.

Two ditches divert water about one-fourth mile above this station.

The observer at this station is S. R. McKissick, who is paid $5.00 per month.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT CANON CITY

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 17	G. H. Russell	114	2.83	3.58	323
	Jan. 29	Grieve & Clayton	107	2.70	3.47	289
	Jan. 29	Grieve & Clayton	107	2.59	3.47	277
	Feb. 20	G. H. Russell	108	2.48	3.50	268
	Mar. 23	Thos. Grieve, Jr.	127	3.33	3.88	423
	Apr. 20	Thos. Grieve, Jr.	94	2.86	3.38	269
	May 12	Thos. Grieve, Jr.	239	4.64	4.90	1,114
	June 23	C. C. Hesmalhalch	474	6.18	6.68	2,933
	July 23	Thos. Grieve, Jr.	320	5.49	5.58	1,759
	Aug. 13	Bunger & Hesmalhalch	227	2.98	4.45	676
	Sept. 13	M. E. Bunger	183	2.26	3.98	414
	Oct. 13	M. E. Bunger	175	6.90	6.96	1,206
	Nov. 21	B. S. Clayton	142	3.27	6.60	464
	Dec. 17	M. E. Bunger	82	4.05	6.20	330
1912	Jan. 18*	C. C. Hesmalhalch	86	4.07	4.92	351
	Feb. 6*	C. C. Hesmalhalch	92	4.16	4.95	381
	Mar. 13	Thos. Grieve, Jr.	99	3.91	5.06	388
	Apr. 10	C. C. Hesmalhalch	124	4.85	5.50	602
	Apr. 24	Thos. Grieve, Jr.	78	3.58	4.72	279
	May 22	C. L. Patterson	284	6.05	7.35	1,715
	May 28	C. C. Hesmalhalch	435	6.58	8.17	2,862
	June 20	Thos Grieve, Jr.	346	5.83	6.55	2,017
	July 27	B. S. Clayton	310	7.06	6.55	2,190
	Sept. 6	B. S. Clayton	116	3.28	4.30	380
	Oct. 11	B. S. Clayton	118	3.13	4.30	370
	Nov. 14	B. S. Clayton	105	2.91	4.14	306
	Nov. 20	Thos. Grieve, Jr.	107	3.23	4.14	346

*Ice conditions.

DISCHARGE OF ARKANSAS RIVER AT CANON CITY FOR 1911

Drainage Area, 3,060 Square Miles. Altitude, 5,368 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	235	290	290	305	305	495	1,832	2,095	1,210	680	520	790	410	
2	235	260	270	335	305	470	2,042	2,462	1,360	645	612	790	410	
3	235	250	270	335	290	410	2,095	3,190	1,115	645	580	690	410	
4	260	270	305	335	320	450	2,148	3,420	1,360	645	520	600	310	
5	215	305	470	370	290	610	2,252	3,362	1,020	580	680	600	410	
6	215	305	430	370	290	675	2,515	3,490	930	520	3,450	690	410	
7	285	335	305	350	280	860	2,570	2,570	800	470	3,870	600	410	
8	330	350	290	350	270	1,065	2,625	2,305	755	420	3,290	600	410	
9	380	350	290	410	270	1,245	2,790	2,358	520	420	2,400	600	390	
10	265	350	305	520	260	1,335	2,790	2,358	520	395	1,980	600	370	
11	265	370	290	550	270	1,290	2,515	2,305	930	370	1,570	600	370	
12	310	335	290	450	250	1,110	2,680	2,252	755	370	1,320	600	370	
13	310	320	290	410	250	940	2,625	2,305	675	395	1,200	600	370	
14	310	290	280	370	260	940	2,790	2,410	715	420	1,030	600	370	
15	310	280	280	370	242	980	2,790	2,042	645	495	1,030	600	370	
16	295	305	290	370	242	1,020	3,190	2,200	550	470	900	465	370	
17	320	320	305	370	242	1,020	2,845	1,885	580	470	900	465	370	
18	295	305	305	370	270	1,155	2,790	2,042	612	445	790	465	370	
19	300	290	320	350	260	1,245	2,790	2,095	580	420	900	465	370	
20	375	290	305	370	270	1,245	2,790	2,200	580	395	900	465	370	
21	375	320	290	410	270	1,020	2,902	2,042	1,035	420	790	465	370	
22	350	305	280	410	270	900	3,075	1,938	1,445	420	790	430	370	
23	280	290	270	410	280	860	2,845	1,885	1,545	420	790	410	370	
24	335	305	290	410	305	900	2,790	1,940	1,260	370	790	410	370	
25	335	290	320	430	320	1,020	2,570	1,780	1,350	370	790	465	340	
26	335	305	320	390	290	1,245	2,410	1,780	1,170	350	790	465	340	
27	335	290	290	320	290	1,335	2,200	1,675	1,035	330	790	465	340	
28	315	290	290	335	335	1,380	2,252	1,570	910	330	790	430	340	
29	270	290	....	335	370	1,530	2,252	1,465	830	330	790	410	340	
30	270	290	....	320	450	1,580	2,148	1,410	830	420	790	410	340	
31	250	290	....	335	....	1,630	....	1,210	790	....	690	....	340	
Total	9,195	9,435	8,530	11,765	8,606	31,960	76,908	68,041	28,412	13,430	37,082	16,245	11,600	Year 1911
Mean	297	304	305	380	287	1,031	2,564	2,195	917	448	1,195	542	374	882
Maximum	380	370	470	550	450	1,630	3,190	3,490	1,545	680	3,870	790	410	3,870
Minimum	215	250	270	305	242	410	1,832	1,210	520	330	520	410	340	250
Run-off per square mile	0.097	0.099	0.100	0.124	0.094	0.337	0.838	0.717	0.300	0.146	0.390	0.198	0.122	0.288
Run-off, depth, inches	0.112	0.114	0.104	0.143	0.105	0.388	0.935	0.827	0.346	0.163	0.450	0.221	0.140	3.919
Run-off, acre-feet	18,238	18,718	16,919	23,336	17,070	63,393	152,547	134,957	56,356	26,638	73,453	32,222	23,009	638,616
Acre-feet per square mile	5.96	6.12	5.53	7.63	5.58	20.72	49.85	44.10	18.42	8.70	24.00	10.53	7.52	208.70

DISCHARGE OF ARKANSAS RIVER AT CANON CITY FOR 1912

Drainage Area, 3,060 Square Miles. Altitude, 5,363 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	340	260	230	455	415	2,750	3,140	1,780	555	370	352	....	
2	340	295	310	415	500	2,420	2,940	1,350	445	370	335	....	
3	340	295	330	522	568	2,800	2,740	1,115	405	370	335	....	
4	340	210	290	612	500	3,200	2,575	1,028	370	370	320	....	
5	340	290	290	710	435	3,560	2,510	945	370	370	370	....	
6	310	310	350	735	375	4,000	1,960	795	370	370	405	....	
7	310	310	330	685	355	4,000	1,900	728	370	370	405	....	
8	310	330	310	612	375	3,740	2,020	695	370	370	405	....	
9	310	350	260	612	845	3,880	2,140	868	370	370	405	....	
10	310	330	370	635	872	3,260	2,380	945	335	370	388	....	
11	350	330	430	635	872	2,560	1,900	728	335	370	370	....	
12	350	330	450	545	928	2,240	1,960	508	370	370	370	....	
13	350	310	390	500	1,010	2,290	2,140	530	335	370	335	....	
14	350	280	310	395	1,070	2,460	2,140	608	320	370	320	....	
15	350	310	260	375	1,010	2,570	2,640	868	370	370	335	....	
16	350	295	260	355	928	2,440	2,020	868	388	370	335	....	
17	350	310	260	375	685	2,370	1,615	1,070	388	370	320	....	
18	350	330	295	395	635	2,350	1,670	1,070	370	370	305	....	
19	350	310	700	522	762	2,140	2,640	985	370	370	305	....	
20	350	280	595	612	982	1,900	2,260	905	370	352	335	....	
21	310	210	545	435	1,190	1,920	2,140	760	370	370	305	....	
22	310	200	455	355	1,490	2,180	2,320	868	370	370	305	....	
23	310	230	435	318	2,070	2,430	2,575	945	425	370	305	....	
24	295	310	415	300	2,140	2,920	2,380	985	405	370	320	....	
25	330	260	435	318	2,420	2,930	2,380	945	405	335	305	....	
26	330	260	478	335	2,790	2,800	2,320	905	405	335	305	....	
27	330	295	455	335	2,930	2,670	2,260	830	388	335	305	....	
28	330	295	455	375	2,860	2,960	2,320	830	370	352	305	....	
29	350	280	500	375	2,640	3,180	2,445	830	370	305	305	....	
30	295	....	522	395	2,900	3,270	2,510	830	370	320	305	....	
31	295	....	522	....	2,980	....	2,445	580	....	370	....	....	
Total	10,235	8,405	12,237	14,243	40,532	84,190	71,385	27,697	11,454	11,214	10,115	....	Period
Mean	330	290	395	475	1,307	2,806	2,303	893	382	362	337	....	901
Maximum	350	350	700	735	2,980	4,000	3,140	1,780	555	370	405	....	4,000
Minimum	295	200	230	300	355	1,900	1,615	508	320	305	305	....	200
Run-off per square mile	0.108	0.095	0.129	0.155	0.427	0.917	0.753	0.292	0.125	0.118	0.110	....	0.294
Run-off, depth, inches	0.124	0.102	0.149	0.173	0.492	1.023	0.868	0.337	0.140	0.136	0.123	....	3.667
Run-off, acre-feet	20,301	16,671	24,272	28,251	80,395	166,991	141,592	54,937	22,719	22,243	20,063	....	598,435
Acre-feet per square mile	6.63	5.45	7.93	9.23	26.27	54.57	46.27	17.95	7.42	7.27	6.56	....	195.55

NOTE.—Ice conditions Jan. 1-Feb. 29, discharge estimated from measurements.

ARKANSAS RIVER AT PUEBLO

This station is located at the Main street bridge, Pueblo, Colorado.

The equipment consists of an automatic gauge and chain gauge. Measurements are made from the Main street bridge and also from bridges above.

The bed of the stream shifts at high stages.

The observer on this stream is paid by the Arkansas Valley Ditch Association.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT PUEBLO

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 17	G. H. Russell	95	2.84	1.99	270
	Jan. 30	Clayton & Grieve	79	2.46	1.90	194
	Feb. 19	G. H. Russell	87	3.25	2.03	283
	Mar. 21	C. L. Chatfield	97	2.86	2.11	278
	Apr. 13	C. L. Chatfield	64	1.70	1.75	109
	Apr. 15	A. A. Weiland	55	1.69	1.69	95
	Apr. 17	C. L. Chatfield	61	1.72	1.70	105
	May 20	A. A. Weiland	295	4.49	3.30	1,323
	June 17	A. A. Weiland			4.88	2,747
	June 22	C. C. Hezmalhalch	533	5.04	4.84	2,686
	July 1	A. A. Weiland	373	4.29	3.80	1,600
	July 5	A. A. Weiland	568	5.41	5.19	3,077
	July 22	Thos. Grieve, Jr.	370	4.40	3.88	1,646
	Aug. 14	Bunger & Hezmalhalch	232	2.84	2.85	661
	Sept. 14	M. E. Bunger	161	2.18	2.46	352
	Oct. 13	M. E. Bunger	191	4.82	3.19	939
1912	Jan. 19*	C. C. Hezmalhalch	96	3.19	3.35	304
	Feb. 7*	C. C. Hezmalhalch	94	2.90	2.35	272
	Mar. 18	Thos. Grieve, Jr.	134	2.54	2.50	341
	Apr. 2	C. L. Patterson	78	1.91	2.05	150
	Apr. 12	C. C. Hezmalhalch	163	2.63	2.70	429
	Apr. 23	Thos. Grieve, Jr.	128	2.14	2.28	276
	May 10	A. A. Weiland	148	4.15	2.75	614
	May 18	C. L. Patterson	159	3.48	2.63	554
	May 23	A. A. Weiland	341	4.40	3.70	1,500
	May 24	C. L. Patterson	433	4.97	4.01	2,152
	June 6	B. S. Clayton	636	5.84	5.49	3,715
	July 30	B. S. Clayton	485	5.07	4.58	2,460
	Sept. 7	B. S. Clayton	120	2.43	2.05	292
	Oct. 14	Chew & Clayton	162	3.10	2.35	504
	Nov. 15	B. S. Clayton	143	3.00	2.28	430

*Ice conditions.

DISCHARGE OF ARKANSAS RIVER AT PUEBLO FOR 1911

Drainage Area, 4,600 Square Miles. Altitude, 4,665 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	240	265	235	295	265	535	1,550	1,625	1,195	822	500	700	540	
2	220	250	205	325	295	535	1,750	1,895	1,350	780	740	740	540	
3	240	250	235	358	325	535	1,750	2,545	1,245	660	700	740	540	
4	265	250	150	295	295	425	1,740	3,030	1,098	740	580	740	460	
5	290	250	325	325	295	610	1,880	3,085	1,145	700	660	740	425	
6	240	275	425	295	265	770	1,930	3,138	955	580	1,950	740	425	
7	240	275	358	325	235	770	2,190	3,085	822	500	2,975	700	390	
8	240	275	178	295	125	1,130	2,290	2,278	822	390	1,842	660	390	
9	240	290	205	325	150	1,275	2,340	2,170	620	425	1,350	660	390	
10	315	290	235	390	100	1,325	2,670	2,060	460	355	1,195	700	390	
11	265	290	235	610	150	1,525	2,260	2,060	500	320	1,050	740	390	
12	240	290	235	535	125	1,375	2,250	1,950	955	355	1,002	660	400	
13	240	295	235	358	150	1,035	2,240	1,950	740	320	1,098	620	400	
14	240	295	265	295	100	1,130	2,275	2,060	740	390	822	540	400	
15	220	325	205	295	100	1,035	2,325	2,005	700	500	822	620	400	
16	180	295	235	325	82	1,130	3,120	2,440	700	540	955	620	400	
17	180	295	265	295	100	1,082	2,760	1,842	580	540	910	620	400	
18	220	205	295	325	65	1,082	2,600	1,735	660	540	1,002	620	400	
19	240	235	265	295	150	1,225	2,440	2,330	540	355	955	700	400	
20	200	205	295	325	150	1,425	2,385	2,005	910	390	1,002	700	400	
21	240	235	325	295	150	1,165	2,545	2,170	1,002	390	955	580	350	
22	315	205	325	390	205	1,060	2,655	2,115	1,460	425	955	540	350	
23	265	295	265	358	235	960	2,655	1,895	1,735	425	955	500	350	
24	265	265	295	390	358	1,000	2,440	1,842	1,298	425	955	500	350	
25	315	265	295	295	358	1,035	2,170	1,680	1,515	355	1,002	460	350	
26	265	235	390	325	325	1,170	2,060	1,680	1,515	355	955	460	350	
27	265	235	325	325	265	1,310	1,895	1,570	1,145	355	1,002	540	350	
28	240	235	390	295	265	1,910	1,735	1,515	1,098	320	910	540	350	
29	265	205	....	265	390	1,460	1,790	1,570	910	355	865	540	350	
30	240	235	....	235	425	1,625	1,735	1,298	910	290	740	540	350	
31	290	205	....	205	....	1,510	....	1,195	955	....	700	....	350	
Total	7,720	8,015	7,691	10,264	6,498	34,159	66,425	63,818	30,280	13,897	32,104	18,760	12,330	Year 1911
Mean	249	259	275	331	217	1,102	2,214	2,059	977	463	1,036	625	398	834
Maximum	315	325	425	610	425	1,910	3,120	3,138	1,735	822	2,975	740	540	3,138
Minimum	180	205	150	205	65	425	1,550	1,195	460	290	500	460	350	65
Run-off per square mile	0.054	0.056	0.060	0.072	0.047	0.240	0.481	0.448	0.212	0.101	0.225	0.136	0.087	0.181
Run-off, depth, inches	0.062	0.065	0.062	0.083	0.053	0.277	0.537	0.517	0.244	0.113	0.260	0.152	0.100	2.457
Run-off, acre-feet	15,312	15,898	15,255	20,359	12,889	67,755	131,752	126,581	60,060	27,564	63,678	37,210	24,456	603,462
Acre-feet per square mile	3.33	3.46	3.32	4.43	2.80	14.73	28.64	27.52	13.06	5.99	13.84	8.09	5.32	131.19

NOTE.—Discharge estimated Jan. 1-Jan. 12 and Nov 25-Dec. 31, 1911.

DISCHARGE OF ARKANSAS RIVER AT PUEBLO FOR 1912

Drainage Area, 4,600 Square Miles. Altitude, 4,665 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	350	270	245	170	240	3,095	2,930	3,518	460	390	2,270	....	
2	340	270	290	140	240	2,770	2,770	1,670	460	390	1,570	....	
3	340	270	290	125	300	2,718	2,560	1,510	358	358	685	....	
4	340	270	290	205	300	2,985	2,245	1,320	390	390	940	....	
5	340	270	290	290	300	3,415	2,298	1,075	260	390	1,570	....	
6	330	290	290	460	300	3,678	1,825	940	292	425	2,270	....	
7	330	290	290	460	240	3,835	1,775	850	260	535	2,490	....	
8	330	290	290	460	190	3,835	1,725	725	325	460	1,885	....	
9	330	335	290	335	365	4,045	1,930	685	325	460	2,655	....	
10	330	312	335	335	670	3,940	2,245	988	260	460	425	....	
11	330	290	335	380	670	3,148	2,035	988	292	460	535	....	
12	320	290	358	380	835	2,930	1,725	685	292	498	460	....	
13	320	290	380	325	925	2,560	2,035	610	498	460	460	....	
14	310	290	335	300	1,020	2,560	2,140	535	325	498	390	....	
15	310	268	290	225	1,020	2,612	2,975	808	390	498	460	....	
16	310	290	290	225	750	2,665	2,762	808	460	460	425	....	
17	310	245	290	225	750	2,455	1,562	940	460	460	390	....	
18	310	268	290	310	670	2,665	1,260	1,035	425	460	425	....	
19	305	268	335	350	630	2,350	2,495	1,035	390	390	358	....	
20	305	245	358	510	750	2,192	1,780	1,035	390	460	390	....	
21	300	245	380	490	835	2,245	2,385	610	425	460	292	....	
22	300	290	312	360	1,162	2,350	1,890	765	425	535	292	....	
23	290	205	290	300	1,730	2,560	2,000	850	460	460	325	....	
24	285	245	290	240	2,140	2,822	2,165	850	460	460	260	....	
25	280	290	290	240	2,298	3,040	2,055	850	460	460	260	....	
26	280	290	245	240	2,665	2,875	1,945	808	498	390	230	....	
27	280	290	205	240	2,930	2,665	1,945	725	460	1,885	390	....	
28	280	245	170	240	2,770	2,612	2,055	685	460	1,885	390	....	
29	280	290	140	240	2,508	3,040	2,815	725	390	2,270	325	....	
30	270	....	170	240	2,770	3,095	3,360	850	390	1,370	260	....	
31	270	....	170	....	2,985	....	3,785	535	....	1,520	....	....	
Total	9,605	8,001	8,823	9,040	35,958	87,757	69,472	30,013	11,740	20,597	24,077	....	Period
Mean	310	276	285	301	1,160	2,925	2,241	968	391	664	803	....	941
Maximum	350	335	380	510	2,985	4,045	3,785	3,518	498	2,270	2,655	....	4,045
Minimum	270	205	140	125	190	2,192	1,260	535	260	358	230	....	125
Run-off per square mile	0.067	0.060	0.062	0.065	0.252	0.636	0.487	0.210	0.085	0.144	0.175	....	0.204
Run-off, depth, inches	0.077	0.065	0.071	0.072	0.290	0.710	0.562	0.242	0.095	0.166	0.195	....	2.545
Run-off, acre-feet	19,052	15,870	17,500	17,930	71,324	174,066	137,798	59,531	23,286	40,854	47,757	....	624,968
Acre-feet per square mile	4.14	3.45	3.80	3.90	15.53	37.84	29.95	12.94	5.06	8.88	10.38	....	135.86

NOTE.—Ice condition Jan. 1-Feb. 5. Discharge estimated from measurements.

ARKANSAS RIVER NEAR NEPESTA

This station is located at the Oxford Farmers' canal dam about two miles above Nepesta.

The equipment consists of an automatic gauge and a staff gauge. Measurements are made from highway bridge at Nepesta during high water.

The bed of the stream is extremely shifting in character, and results are poor.

The gauge is taken care of by the head gate keeper of the Oxford Farmers' canal free of charge.

Measurements made in 1911 were not sufficient for estimating daily discharges.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER NEAR NEPESTA

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 1	Thos. Grieve, Jr.	84	2.82	0.70	237
Mar. 21	C. L. Chatfield	82	2.79	0.82	229
Apr. 13	C. L. Chatfield	45	1.49	0.33	67
May 12	A. A. Weiland	275	4.22	1.22	1,158
May 19	Thos. Grieve, Jr.			1.25	1,034
May 27	A. A. Weiland	309	3.71	1.42	1,146
June 8	A. A. Weiland	299	5.47	1.60	1,638
June 16	A. A. Weiland	381	5.28	1.90	2,016
June 30	A. A. Weiland	308	5.19	1.58	1,600
1912 Feb. 7*	C. C. Hesmalhalch	114	2.37	0.80	271
Mar. 12	Thos. Grieve, Jr.			0.85	255
Apr. 12	C. C. Hesmalhalch			0.78	302
Apr. 29	C. L. Patterson	130	2.07	0.70	270
May 20	C. L. Patterson	318	3.33	1.20	1,055
May 21	C. L. Patterson	328	3.91	1.40	1,286
May 24	B. S. Clayton	442	5.00	2.10	2,210
May 27	C. L. Patterson	498	4.77	2.21	2,378
May 30	B. S. Clayton	403	4.84	2.00	1,950
June 7	B. S. Clayton	597	5.58	2.78	3,336
July 3	B. S. Clayton	453	4.30	1.65	1,946
July 15	B. S. Clayton	831	4.46	2.90	3,710
Sept. 9	B. S. Clayton	152	1.68	0.60	255
Oct. 18	B. S. Clayton	195	2.20	0.85	425

*Ice conditions.

DISCHARGE OF ARKANSAS RIVER AT NEPESTA FOR 1912

Drainage Area, 9,130 Square Miles. Elevation, 4,396 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				330	225	2,600	2,310	5,240	540	200	320		
2				415	325	2,360	2,030	3,280	500	200	390		
3				270	350	1,920	1,830	1,640	460	320	200		
4				225	400	2,520	1,720	2,600	390	255	150		
5				210	460	2,690	1,560	1,375	355	320	150		
6				230	430	2,850	1,720	1,375	355	320	255		
7				290	360	3,020	1,620	900	320	390	200		
8				250	340	2,860	1,520	750	255	460	255		
9				210	230	3,150	1,560	790	255	460	320		
10				230	365	3,440	1,950	1,068	255	500	425		
11				270	375	2,930	2,190	1,188	190	425	390		
12				310	380	1,950	1,830	1,068	165	460	390		
13				350	675	2,100	1,830	900	320	425	175		
14				330	900	2,260	1,890	790	425	460	200		
15				190	900	2,850	3,320	1,250	390	460	175		
16				135	900	2,550	2,320	1,438	390	500	200		
17				170	955	3,400	1,420	945	425	460	200		
18			250	270	600	3,430	1,620	1,125	390	500	228		
19			330	330	750	2,450	2,010	1,010	390	500	228		
20			290	310	1,068	2,220	1,890	1,010	390	460	320		
21			230	210	1,125	1,870	2,010	2,135	390	390	200		
22			310	330	1,438	2,030	1,830	425	355	460	150		
23			370	270	1,920	1,900	1,950	500	460	460	200		
24			310	270	2,680	2,370	1,950	460	460	390	150		
25			290	270	2,285	2,620	1,890	425	460	320	200		
26			290	230	2,135	2,560	1,830	390	460	320	150		
27			310	270	2,135	2,570	1,950	390	425	255	150		
28			330	270	2,210	2,420	1,890	390	425		200		
29			250	270	2,600	2,680	1,890	390	320		355		
30			350	270	2,600	2,610	2,320	390	320	460	228		
31			330		2,935		5,240	880		425			
Total			4,240	7,985	35,051	77,180	61,000	36,517	11,235	11,555	7,154		Period
Mean			303	266	1,131	2,573	1,968	1,178	374	398	238		984
Maximum			370	415	2,935	3,440	5,240	5,240	540	500	425		5,240
Minimum			230	135	225	1,870	1,420	390	165	200	150		135
Run-off per square mile													
Run-off, depth, inches													
Run-off, acre-feet			8,410	15,838	69,524	153,087	120,993	72,431	22,285	22,919	14,190		499,678
Acre-feet per square mile													

ARKANSAS RIVER AT LA JUNTA

This station was established by the Arkansas Valley Ditch Association. In 1911 it was located at the east bridge at La Junta. In 1912 the gauge was moved about one-half mile downstream.

The equipment consists of an automatic gauge and auxiliary slope gauge.

The bed of the stream is sand and gravel and is shifting in character.

Observers at this station have been paid by the Arkansas Valley Ditch Association.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT LA JUNTA

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	May 19	A. A. Weiland	134	2.13	1.25	286
	May 23	A. A. Weiland	180	2.53	1.52	455
	June 7	A. A. Weiland	226	2.90	1.68	655
	June 10	H. C. Ogden	124	1.74	1.10	244
	June 16	A. A. Weiland	210	2.64	1.71	558
	June 26	A. A. Weiland	207	2.84	1.80	590
	June 28	A. A. Weiland	185	2.95	1.73	546
	June 29	H. C. Ogden	210	3.15	1.98	774
	Aug. 2	H. C. Ogden	168	2.23	1.30	377
1912	Apr. 11	C. L. Patterson	55	1.72	0.95	87
	Apr. 15	C. L. Patterson	59	1.40	0.80	83
	Apr. 20	C. L. Patterson	112	2.77	1.50	310
	Apr. 25	C. C. Hesmalhalch	32	1.25	0.70	40
	May 21	C. L. Patterson	162	3.02	1.95	491
	May 30	B S. Clayton	214	2.59	1.90	554
	June 10	B. S. Clayton	250	3.23	2.18	807
	July 2	B. S. Clayton	82	1.69	1.10	138
	July 17	B. S. Clayton	76	1.82	1.13	138
	Aug. 30	B. S. Clayton	20	1.10	0.40	22
	Oct. 17	B. S. Clayton	55	2.10	1.14	116

DISCHARGE OF ARKANSAS RIVER AT LA JUNTA FOR 1912

Drainage Area, 12,200 Square Miles. Elevation, 4,052 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec	
1					40	480	105	8,500	190	105	555		
2					60	685	120	2,600	40	80	518		
3					60	480	190	385	45	80	518		
4					70	598	152	385	70	105	518		
5					80	640	170	210	52	120	355		
6					70	518	480	210	32	190	232		
7					60	598	480	60	45	255	210		
8					60	518	518	45	30	518	170		
9					52	685	555	105	92	555	170		
10					60	778	640	105	70	355	170		
11				92	60	555	640	305	70	280	232		
12				80	60	210	598	480	52	120	190		
13				70	70	555	518	355	35	120	210		
14				70	92	640	730	210	60	120	330		
15				70	220	480	930	105	52	135	232		
16				52	340	448	825	170	45	120	210		
17				40	275	518	232	80	35	120	135		
18				45	220	2,360	105	52	60	135	305		
19				40	170	448	232	105	170	120	255		
20				32	250	135	555	255	170	170	255		
21				60	495	152	640	330	190	232	305		
22				280	540	280	685	210	170	135	280		
23				305	480	330	778	92	210	190	210		
24				135	330	330	555	52	280	190	448		
25				52	400	305	730	32	355	170	210		
26				40	440	415	555	40	255	330	255		
27				40	520	255	555	35	305	355	280		
28				35	530	190	730	28	280	305	330		
29				35	350	40	480	28	190	415	480		
30				35	518	105	598	25	105	518	448		
31					730		4,250	70		518			
Total				1,608	7,702	14,731	19,331	15,664	3,755	7,161	9,016		**Period**
Mean				80	248	491	624	505	125	231	301		337
Maximum				305	730	2,360	4,250	8,500	355	555	555		8,500
Minimum				32	40	40	105	25	30	80	135		25
Run-off per square mile													
Run-off, depth, inches													
Run-off, acre-feet				3,189	15,277	29,218	38,343	31,070	7,448	14,204	17,884		156,633
Acre-feet per square mile													

ARKANSAS RIVER AT FORT LYON NEAR LAS ANIMAS

This station, established April 3, 1911, is located at the United States Naval Sanitarium at Fort Lyon about six miles below Las Animas. It has been maintained in co-operation with the Arkansas Valley Ditch Association.

The equipment consists of automatic and staff gauges located at the Sanitarium and a cable of about 700 feet span one-half mile below.

Conditions at this station are very poor. The channel shifted away from the gauges in 1912 and there being no other favorable location the station was abandoned.

The observer was Dr. Jno. F. Murphy of the United States Naval Sanitarium whose services were furnished free of charge.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT FT. LYON

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Apr. 4	C. L. Chatfield	50	1.72	1.35	86
Apr. 15	C. L. Chatfield	29	1.14	0.98	33
May 13	H. C. Ogden			1.98	383
May 18	Thos. Grieve, Jr.	37	1.30	1.28	48
July 10	A. A. Weiland	141	2.32	1.89	328
July 15	H. C. Ogden	307	3.88	2.80	1,192
Sept. 12	C. L. Patterson	42	1.20	1.60	50
Sept. 19	C. L. Patterson	26	1.24	1.55	32
Sept. 27	C. L. Patterson	27	1.24	1.60	34
Oct. 8	C. L. Patterson	161	3.21	2.05	518

DISCHARGE OF ARKANSAS RIVER AT FORT LYON FOR 1911

Drainage Area, —— Square Miles. Altitude, 3,910 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						50	480	440	510	145	100	560	440	
2						50	365	480	390	165	110	600	440	
3						45	192	560	315	165	130	600	440	
4						60	300	650	410	60	120	440	460	
5					75	50	605	400	300	60	175	390	460	
6					55	50	605	750	115	70	270	390	340	
7					50	40	605	1,310	70	50	810	560	560	
8					55	40	400	970	70	55	655	560	560	
9					68	55	270	520	55	60	840	390	650	
10					35	88	300	365	40	50	840	220	290	
11					25	330	330	480	40	45	950	240	290	
12						440	605	440	25	45	1,230	265	240	
13						400	242	915	30	30	950	290	440	
14						270	270	1,430	25	30	840	460	520	
15					40	160	400	1,370	70	45	840	650	440	
16					45	90	480	700	45	45	760	460	410	
17					45	65	480	1,745	30	45	650	340	440	
18					45	40	300	750	30	45	650	170	460	
19					45	55	150	365	25	45	760	340	460	
20					40	205	330	2,200	25	45	790	320	410	
21					45	400	605	2,330	20	100	840	380	410	
22					45	610	440	2,530	20	80	650	520	560	
23					40	480	330	2,265	30	45	740	520	410	
24					45	400	300	690	60	45	650	650	410	
25					45	365	192	390	85	45	700	560	410	
26					50	300	192	505	170	45	600	560		
27					55	215	365	415	260	45	460	410		
28					55	560	520	410	260	50	400	410		
29					45	2,395	605	530	150	75	310	420		
30					45	860	750	440	360	80	400	420		
31						480		440	175		520			
Total					1,093	9,648	12,008	27,785	4,210	1,905	18,740	13,095	10,650	Period 1911
Mean					48	311	400	896	136	64	605	436	426	378
Maximum					75	2,395	750	2,530	510	165	1,230	650	650	2,530
Minimum					25	40	150	365	20	30	100	170	240	20
Run-off per square mile														
Run-off, depth, inches														
Run-off, acre-feet					2,168	19,137	23,818	55,111	8,350	3,778	37,170	25,974	21,124	196,629
Acre-feet per square mile														

ARKANSAS RIVER AT HOLLY

This station is located at a pile highway bridge crossing the river about one-fourth mile from Holly, Colorado.

The equipment consists of thirteen scales and open pulleys located at different points along the bridge rail, so that chain gauge can be used on any scale.

During 1912 an automatic gauge was installed by the Arkansas Valley Ditch Association.

The bed of the stream is composed of sand and gravel and is extremely shifting in character.

The observer during 1911 was S. W. Jones, who was paid $5.00 per month. During 1912 the gauge was read by H. C. Ogden, who is paid by the Arkansas Valley Ditch Association.

DISCHARGE MEASUREMENTS OF ARKANSAS RIVER AT HOLLY

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 2	Thos. Grieve, Jr.	38	1.53	1.20	58
Feb. 28*	Thos. Grieve, Jr.	......	......	......	64
Mar. 24	C. L. Chatfield	27	1.59	1.35	43
Apr. 3	C. L. Chatfield	24	1.50	1.30	36
Apr. 15	C. L. Chatfield	6	1.01	1.20	6
May 17	Thos. Grieve, Jr.	......	......	......	5
July 16	Thos. Grieve, Jr.	332	1.94	2.60	645
July 20	H. C. Ogden	'123	1.45	2.10	179
July 21	H. C. Ogden	1,141	3.30	3.95	3,770
Aug. 25	Thos. Grieve, Jr.	......	......	1.30	5
Sept. 15	C. L. Patterson	......	1.00	......	4
Oct. 3	C. L. Patterson	2	1.03	......	2
Oct. 18	Thos. Grieve, Jr.	16	1.31	1.50	21
Dec. 2	W. F. Hicks	414	2.38	1.50	1,004
Dec. 4	W. F. Hicks	181	1.94	1.00	351
Dec. 6	W. F. Hicks	251	2.08	1.18	521
Dec. 8	W. F. Hicks	164	1.81	0.95	298
Dec. 9	W. F. Hicks	165	1.70	0.93	282
Dec. 11	W. F. Hicks	162	1.79	0.95	290
1912 Feb. 9	C. C. Hesmalhalch	154	2.74	3.45	424
Mar. 15*	Thos. Grieve, Jr.	168	2.32	2.96	390
Mar. 28	C. L. Patterson	143	1.66	2.36	237
Apr. 12	H. C. Ogden	......	......	2.38	232
Apr. 13	H. C. Ogden	......	......	2.30	222
Apr. 20	C. L. Patterson	64	1.70	2.10	109
Apr. 20	C. L. Patterson	......	......	2.15	163
Apr. 25	C. L. Patterson	37	1.26	1.90	46
June 10	C. L. Patterson	......	......	2.57	455
June 12	B. S. Clayton	50	1.28	2.00	64
June 18	B. S. Clayton	794	2.77	3.58	2,200
June 19	B. S. Clayton	1,160	3.10	4.20	3,600
June 21	B. S. Clayton	427	2.04	2.96	871
June 23	H. C. Ogden	......	......	2.63	412
June 24	B. S. Clayton	891	2.78	3.77	2,470
June 27	B. S. Clayton	443	2.30	3.10	1,020
June 28	B. S. Clayton	342	2.09	2.92	716
June 29	B. S. Clayton	258	1.78	2.69	458
June 30	C. L. Patterson	......	......	2.60	313
July 1	B. S. Clayton	134	1.86	2.48	250
July 3	C. L. Patterson	......	......	2.35	148
July 5	C. L. Patterson	......	......	2.05	61
July 18	B. S. Clayton	388	2.19	3.00	850
July 20	B. S. Clayton	73	1.77	2.12	129
Aug. 1	B. S. Clayton	1,670	4.40	5.20	7,360
Aug. 5	B. S. Clayton	356	2.40	2.97	857
Aug. 8	B. S. Clayton	265	2.00	2.70	529
Aug. 10	B. S. Clayton	138	1.79	2.41	247
Aug. 12	B. S. Clayton	75	1.53	2.12	115
Aug. 17	B. S. Clayton	220	1.97	2.59	434
Aug. 18	C. L. Patterson	......	......	2.47	297
Sept. 12	C. L. Patterson	......	......	4.43	4,300
Sept. 14	H. C. Ogden	......	......	2.78	644
Sept. 15	H. C. Ogden	......	......	2.46	323
Sept. 16	B. S. Clayton	81	2.34	2.40	190

*Ice conditions. Dec. 2 to Dec. 11, 1911, gauge at new datum.

DISCHARGE OF ARKANSAS RIVER AT HOLLY FOR 1911

Drainage Area, —— Square Miles. Altitude, 3,387 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	10	58	58	70	54	6	102	13	62	5	5	135	302	
2	10	58	58	90	45	6	102	21	50	5	2	235	490	
3	10	58	58	118	42	6	102	21	33	5	2	545	490	
4	10	58	58	118	37	6	102	33	50	5	2	490	388	
5	10	58	58	67	35	6	33	33	320	5	2	752	340	
6	10	58	58	75	33	6	33	33	210	5	5	610	435	
7	17	58	58	75	31	6	33	410	210	5	5	545	340	
8	30	52	58	75	30	5	33	240	140	5	5	545	302	
9	17	52	58	70	28	3	33	180	73	5	5	830	302	
10	17	55	58	70	30	2	33	210	62	5	5	830	435	
11	17	52	58	70	17	2	33	180	21	5	5	1,340	340	
12	17	52	58	64	15	2	33	180	2	5	5	205	302	
13	17	52	58	58	8	2	33	240	8	5	5	235	340	
14	17	52	58	60	6	2	33	240	8	5	21	302	400	
15	17	52	58	68	6	2	33	240	8	5	21	490	400	
16	17	52	58	60	6	2	33	240	7	5	21	490	400	
17	17	52	58	65	6	2	33	320	7	5	21	235	400	
18	39	52	58	52	6	2	13	365	7	5	21	205	400	
19	48	52	58	52	6	2	13	465	6	5	21	155	400	
20	30	52	58	50	6	2	13	790	6	5	21	115	400	
21	30	52	58	48	6	4	13	2,400	6	5	25	115	450	
22	30	52	58	48	6	3	13	2,020	6	5	35	115	450	
23	30	52	58	46	6	3	13	3,940	6	5	30	115	450	
24	30	52	58	45	6	3	13	2,270	10	5	35	135	450	
25	30	52	61	45	6	3	13	790	8	5	35	135	450	
26	39	52	65	54	6	2	13	320	8	5	90	80	450	
27	30	52	65	54	6	2	13	159	8	5	100	98	450	
28	39	52	65	54	6	7	21	138	8	5	90	80	450	
29	30	52	....	54	6	950	13	138	8	2	340	80	450	
30	30	55	....	54	6	2,665	13	188	8	5	340	135	450	
31	30	52	....	54	....	465	....	120	8	....	388	....	450	
Total	725	1,660	1,648	1,983	507	4,179	1,014	16,887	1,374	147	1,708	10,377	12,556	Year 1911
Mean	23	53	59	64	17	135	34	545	44	5	55	346	405	148
Maximum	48	58	65	118	54	2,665	102	3,940	320	5	388	1,340	490	3,940
Minimum	10	52	58	45	6	2	13	13	2	2	2	80	302	2
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	1,414	3,293	3,269	3,933	1,005	8,289	2,011	33,495	2,725	292	3,388	20,582	24,904	107,186
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....

DISCHARGE OF ARKANSAS RIVER AT HOLLY FOR 1912

Drainage Area, —— Square Miles. Altitude, 3,387 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	400	435	145	80	5	315	7,790	5	205	550	....	
2	....	400	650	125	22	5	275	7,110	5	240	670	....	
3	....	400	700	145	15	5	205	4,590	5	178	178	....	
4	....	400	800	105	15	5	178	3,195	5	178	150	....	
5	....	400	855	172	22	5	110	1,280	5	130	178	....	
6	....	420	540	200	30	5	42	1,100	5	95	240	....	
7	....	420	540	145	30	5	15	785	5	95	80	....	
8	....	420	390	265	15	5	6	655	5	95	80	....	
9	....	420	390	345	15	10	5	305	5	55	80	....	
10	....	420	265	265	10	310	6	265	6	55	80	....	
11	....	420	435	265	12	105	5	145	6	178	80	....	
12	....	400	390	265	15	90	5	125	2,665	95	68	....	
13	....	420	345	270	30	90	6	90	1,570	80	80	....	
14	....	430	345	270	30	75	5	145	540	68	80	....	
15	....	435	390	170	30	105	4	2,925	305	55	95	....	
16	....	435	390	120	30	200	4	1,470	240	55	110	....	
17	....	540	345	80	15	345	355	655	150	55	110	....	
18	....	540	345	80	15	2,700	670	345	178	55	110	....	
19	....	305	435	120	15	3,930	540	172	150	55	355	....	
20	....	265	435	100	10	2,130	145	125	110	55	402	....	
21	....	200	540	80	10	1,090	45	105	150	55	55	....	
22	....	200	345	50	8	745	20	90	150	95	355	....	
23	....	200	435	50	8	402	8	75	110	110	150	....	
24	....	145	435	50	8	2,250	6	75	80	110	402	....	
25	....	200	345	50	8	1,000	6	75	110	110	450	....	
26	....	305	305	40	5	610	20	75	110	95	110	....	
27	....	265	265	30	5	745	8	75	150	80	130	....	
28	....	265	232	30	5	745	6	45	178	80	130	....	
29	....	435	145	30	5	450	6	32	110	80	150	....	
30	....	....	145	80	5	315	10	5	150	95	110	....	
31	....	....	125	....	5	....	172	5	....	110	....	....	
Total	....	10,505	12,737	4,142	528	18,482	3,203	33,929	7,263	3,097	5,818	....	**Period**
Mean	....	362	411	138	17	616	103	1,094	242	100	194	....	328
Maximum	....	540	855	345	80	3,930	670	7,790	2,665	240	670	....	7,790
Minimum	....	145	125	30	5	5	4	5	5	55	68	....	4
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	....	20,837	25,264	8,216	1,047	36,659	6,354	67,299	14,406	6,143	11,540	....	197,765
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....

PURGATOIRE RIVER AT TRINIDAD

This station is located at the Animas street bridge.

The equipment consists of a chain gauge installed by the United States Geological Survey.

The bed of the stream is sand and gravel and is shifting.

The observer at this station during 1911 was H. D. Albertson. During 1912 the observers were H. D. Albertson and J. E. Albertson. The salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF PURGATOIRE RIVER AT TRINIDAD

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 18	G. H. Russell	9	1.17	3.31	10
	Feb. 18	G. H. Russell	7.3	0.62	3.41	4.5
	Mar. 9	W. B. Freeman	11	1.44	3.41	16
	Apr. 10	G. H. Russell	4	0.52	3.06	2.1
	May 19	W. B. Freeman	25	2.78	3.86	69
	July 1	G. H. Russell	24	2.32	3.60	55
	July 21*	G. H. Russell	....	....	9.50	6,100
	July 22	G. H. Russell	90	4.86	4.48	437
	Aug. 20	W. B. Freeman	24	1.57	3.48	38
	Aug. 24	Thos. Grieve, Jr.	35	3.60	3.90	126
	Sept. 5	G. H. Russell	26	2.19	3.55	57
	Oct. 26	W. B. Freeman	29	2.31	3.88	67
1912	Feb. 15	G. H. Russell	14	0.96	3.56	14
	Mar. 16	Thos. Grieve, Jr.	20	2.00	3.66	40
	July 16	B. S. Clayton	90	3.47	4.84	312
	Aug. 29	B. S. Clayton	32	2.22	4.50	71
	Sept. 27	B. S. Clayton	14	3.00	4.53	43
	Nov. 13	B. S. Clayton	19	1.32	4.43	25

*Measurement by Kutter's formula.

DISCHARGE OF PURGATOIRE RIVER AT TRINIDAD FOR 1911

Drainage Area, 742 Square Miles. Altitude, 5,985 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	9	8	15	10	30	200	100	115	50	21	74	5	
2	....	9	8	38	10	27	94	106	100	50	42	74	5	
3	....	8	8	58	10	27	88	130	93	50	42	88	7	
4	....	9	8	28	16	22	87	350	75	42	42	88	7	
5	....	9	8	34	6	30	95	714	66	42	1,120	88	7	
6	....	9	8	38	5	51	102	1,850	66	36	390	74	7	
7	....	9	6	24	4	65	101	170	57	36	260	70	9	
8	....	10	6	18	3	90	108	375	50	36	230	65	7	
9	....	10	6	15	2	112	108	190	50	36	230	50	7	
10	....	10	6	15	2	116	120	170	88	36	220	40	7	
11	....	10	6	15	3	112	109	130	88	36	180	40	12	
12	....	10	6	15	3	96	120	375	82	36	160	30	7	
13	....	10	6	15	3	61	120	210	57	36	160	30	7	
14	....	10	6	10	2	138	120	1,200	50	46	150	20	7	
15	....	8	7	10	2	96	140	1,850	50	52	140	15	7	
16	....	9	7	10	2	96	125	2,400	170	50	100	15	7	
17	....	10	5	10	2	75	100	190	75	50	88	10	7	
18	....	10	5	20	2	75	220	3,100	278	50	88	10	7	
19	....	10	5	18	2	68	400	570	50	46	88	10	7	
20	....	10	5	16	2	68	110	450	50	42	115	10	7	
21	....	10	5	16	2	68	110	630	50	38	110	10	7	
22	....	10	5	16	2	68	475	210	109	36	88	10	7	
23	....	10	5	18	2	64	150	400	150	36	78	10	7	
24	....	8	5	20	2	62	120	480	300	36	74	10	7	
25	....	8	5	20	48	62	92	219	540	36	74	10	7	
26	....	8	6	20	16	31	76	210	100	30	74	7	7	
27	....	8	6	20	6	34	190	190	75	30	74	7	7	
28	....	9	6	20	7	50	70	210	88	25	74	7	7	
29	....	10	....	12	7	82	77	350	75	25	74	7	7	
30	....	10	....	10	5	80	77	291	66	25	74	7	7	
31	....	8	....	10	....	93	....	190	57	....	74	....	7	
Total	....	288	173	604	188	2,149	4,104	18,010	3,320	1,175	4,734	986	220	Year 1911
Mean	....	9.3	6.2	20	6.3	69	137	581	107	39	153	33	7.1	98
Maximum	....	10	8	58	48	138	475	3,100	540	52	1,120	88	12	3,100
Minimum	....	8	5	10	2	22	70	100	50	25	21	7	5	2
Run-off per square mile	....	0.012	0.008	0.027	0.008	0.093	0.185	0.783	0.144	0.052	0.206	0.044	0.010	0.132
Run-off, depth, inches	....	0.014	0.008	0.031	0.009	0.107	0.207	0.903	0.166	0.058	0.238	0.049	0.012	1.792
Run-off, acre-feet	....	571	343	1,198	374	4,262	8,140	35,722	6,585	2,331	9,390	1,956	436	71,308
Acre-feet per square mile	....	0.77	0.46	1.61	0.50	5.74	10.97	48.14	8.88	3.14	12.66	2.64	0.59	96.10

NOTE.—Ice conditions Nov. 25-Dec. 31. Discharge estimated.

DISCHARGE OF PURGATOIRE RIVER AT TRINIDAD FOR 1912

Drainage Area, 742 Square Miles. Altitude, 5,985 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	7	14	28	75	111	297	370	265	85	38	30	....	
2	7	14	33	52	111	297	332	265	65	79	30	....	
3	7	14	33	75	131	297	297	450	65	57	30	....	
4	7	14	33	93	131	297	297	430	65	48	30	....	
5	7	14	39	93	121	297	265	390	65	153	30	....	
6	7	14	39	93	111	370	235	370	50	68	30	....	
7	7	14	39	75	102	584	205	215	50	48	30	....	
8	7	14	39	75	102	332	205	205	50	48	30	....	
9	9	14	39	75	111	538	179	205	40	48	30	....	
10	9	14	40	75	131	332	155	140	40	48	38	....	
11	9	14	40	75	111	584	155	300	125	48	38	....	
12	9	14	40	75	192	332	220	310	85	48	38	....	
13	9	14	40	75	155	314	155	320	75	48	38	....	
14	9	14	45	75	131	297	155	210	75	48	38	....	
15	9	14	45	75	220	281	632	225	80	38	38	....	
16	9	14	45	67	220	297	390	165	70	38	38	....	
17	9	14	59	59	192	430	332	160	70	38	48	....	
18	9	18	59	59	220	370	281	150	70	38	38	....	
19	9	18	102	52	281	584	351	140	70	38	38	....	
20	9	20	235	45	297	297	297	130	55	38	38	....	
21	12	23	102	45	297	492	297	585	55	38	38	....	
22	12	28	75	45	332	370	265	185	55	38	38	....	
23	12	33	75	45	297	450	265	155	55	38	38	....	
24	12	33	45	45	281	450	265	115	50	38	57	....	
25	12	33	45	59	281	450	410	95	50	38	38	....	
26	12	28	45	67	281	430	370	90	50	38	38	....	
27	12	28	33	67	314	430	265	85	50	38	38	....	
28	12	23	52	167	297	410	265	80	48	38	38	....	
29	12	23	67	111	314	430	351	70	48	48	38	....	
30	12	....	84	131	332	410	332	260	48	48	38	....	
31	12	....	59	....	332	....	332	110	....	48	....	....	
Total	296	546	1,754	2,220	6,539	11,749	8,925	6,875	1,859	1,503	1,097	....	Period
Mean	10	19	57	74	211	392	288	222	62	48	37	....	129
Maximum	12	33	235	167	332	584	632	585	125	153	57	....	632
Minimum	7	14	28	45	102	281	155	70	40	38	30	....	7
Run-off per square mile	0.013	0.026	0.077	0.100	0.284	0.528	0.388	0.299	0.084	0.065	0.050	....	0.174
Run-off, depth, inches	0.015	0.028	0.089	0.112	0.327	0.589	0.447	0.345	0.094	0.075	0.056	....	2.177
Run-off, acre-feet	587	1,083	3,479	4,403	12,970	23,304	17,702	13,636	3,687	2,981	2,176	....	86,008
Acre-feet per square mile	0.79	1.46	4.69	5.93	17.48	31.41	23.86	18.38	4.97	4.02	2.93	....	115.92

NOTE.—Ice conditions Jan. 1-Feb. 17. Discharge estimated from measurements.

HUERFANO RIVER AT BADITO

This station established August 28, 1912 is located at concrete bridge at Badito about eighteen miles from Walsenburg, Colorado.

The equipment consists of a chain gauge fastened to the concrete railing of the bridge.

The bed of the stream is extremely shifting in character.

The observer and expenses of making measurements are paid by the Huerfano Valley Irrigation Company.

DISCHARGE MEASUREMENTS OF HUERFANO RIVER AT BADITO

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 Aug. 28	B. S. Clayton	2.8	2.28	1.01	6.4
Oct. 1	B. S. Clayton	1.6	1.60	0.52	2.6
Nov. 12	B. S. Clayton	1.6	1.20	0.54	1.9

DISCHARGE OF HUERFANO RIVER AT BADITO FOR 1912

Drainage Area, 550 Square Miles. Altitude, 6,387 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1									6.3	2.1	5.2		
2									6.3	1.8	5.2		
3									7.4	2.1	4.3		
4									6.3	1.8	3.4		
5									6.8	1.6	3.4		
6									6.3	1.6	2.7		
7									5.8	1.8	2.7		
8									6.8	1.6	2.7		
9									8.0	1.6	2.7		
10									7.4	1.6	2.1		
11									6.8	1.6	2.1		
12									5.8	2.1	2.1		
13									6.3	2.1	1.6		
14									5.8	2.1	1.6		
15									5.8	2.1	1.6		
16									4.8	2.1	2.1		
17									3.8	2.1	2.1		
18									3.8	2.1	2.1		
19									2.7	2.1	2.7		
20									2.4	2.1	2.7		
21									2.7	2.1	2.7		
22									1.8	2.7	2.7		
23									2.1	3.1	4.8		
24									2.4	4.3	4.3		
25									2.1	4.8	4.8		
26									1.8	5.2	7.4		
27									1.6	4.8	7.4		
28								6.3	2.1	5.2	6.8		
29								6.3	2.1	4.8	6.8		
30								6.8	2.1	5.2	6.8		
31								8.0		5.2			
Total								27.4	136.2	85.5	109.6		Period
Mean								6.8	4.5	2.8	3.7		3.8
Maximum								8.0	8.0	5.2	7.4		8.0
Minimum								6.3	1.6	1.6	1.6		1.6
Run-off per square mile								0.012	0.008	0.005	0.007		0.007
Run-off, depth, inches								0.002	0.009	0.006	0.008		0.025
Run-off, acre-feet								54	270	170	217		711
Acre-feet per square mile								0.10	0.49	0.31	0.39		1.29

Grand River Drainage

GRAND RIVER AT SULPHUR SPRINGS

This station is located at highway bridge between the Denver, Northwestern & Pacific station and town. The equipment consists of a chain gauge. Measurements are made from the bridge and by wading. Records have been furnished by the United States Geological Survey.

DISCHARGE MEASUREMENTS OF GRAND RIVER AT SULPHUR SPRINGS

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 17*	R. H. Fletcher	50	2.02	2.90	102
Feb. 14*	R. H. Fletcher	61	1.68	2.70	103
Apr. 3	R. H. Fletcher	146	2.26	2.09	330
July 29	C. L. Chatfield	217	2.66	2.72	578
Sept. 5	C. L. Chatfield	145	1.99	2.10	289
Sept. 13	H. B. Waha	83	2.74	1.97	228
1912 Feb. 14*	H. B. Waha	70	1.45	2.80	100
Apr. 2*	J. L. Mathias	53	2.36	3.25	126
June 13	J. L. Mathias	899	5.46	6.40	4,910
July 13	C. L. Chatfield	543	5.76	5.40	3,131
Sept. 20	R. Richards	151	2.27	2.27	343

*Ice conditions.

DISCHARGE OF GRAND RIVER AT SULPHUR SPRINGS FOR 1911

Drainage Area, 946 Square Miles. Altitude, 7,665 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						745	3,670	2,500			330			
2						610	3,520		445	350	330			
3					286	550	3,220	2,200			330			
4						610	3,080				350	165		
5						1,020	3,080	2,560	395	290	330	165		
6						1,520	3,010	2,200			330	180		
7						1,770		1,980	350		330			
8						1,720		1,770	350			198		
9						2,040		1,570	350			198		
10						2,420			350			215		
11						1,770			330		330			
12					215	1,570			350		330			
13					198	1,480				240	330			
14					165		3,600		370		290			
15					150		3,520		350		290			
16									350					
17					232		3,300							
18					198		3,370				290			
19					250			955	330		290			
20					290			920			215			
21					338			850	330		290			
22					370				610		270			
23									550		215			
24					395						250			
25					520				470					
26					510				445					
27					568									
28					610						232			
29					766		2,560	610	330		232			
30							2,560				215			
31											198			
Total					6,061	17,825	38,490	18,115	7,055	880	6,597	1,121		Period 1911
Mean														
Maximum														
Minimum														
Run-off per square mile														
Run-off, depth, inches														
Run-off, acre-feet					12,022	35,356	76,345	35,931	13,994	1,745	13,085	2,223		190,702
Acre-feet per square mile														

DISCHARGE OF GRAND RIVER AT SULPHUR SPRINGS FOR 1912

Drainage Area, 946 Square Miles. Altitude, 7,665 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						4,290	2,810						
2					780	4,290	3,010	1,820					
3					850	4,380		1,570					
4					710	5,330							
5						5,870	2,560						
6					710	5,870					150		
7					520	6,700	2,560				138		
8					675	6,700					150		
9					580	6,700					165		
10					710	5,510							
11					550						150		
12					520			850			165		
13					495	4,800					165		
14					420								
15						2,880	2,140						
16						3,080					150		
17								710					
18					1,220								
19							2,140	640					
20					2,090				358				
21													
22					3,440		2,090						
23								550					
24								495					
25					3,970								
26													
27					4,130								
28							2,140						
29					2,620								
30					2,680								
31					4,970		2,090						
Total					32,640	72,270	21,540	6,635	358		1,233		Period
Mean													
Maximum													
Minimum													
Run-off per square mile													
Run-off, depth, inches													
Run-off, acre-feet					64,741	143,348	42,724	13,161	710		2,446		267,130
Acre-feet per square mile													

GRAND RIVER NEAR KREMMLING

This station is located at the upper end of Gore canon about three miles west of Kremmling. The equipment consists of a slope gauge, Friez automatic gauge and cable with car. The channel is scoured out at high water and silt deposited at low water. The observer is H. C. Rogers, whose salary is $4.00 per month.

DISCHARGE MEASUREMENTS OF GRAND RIVER NEAR KREMMLING

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 17*	R. H. Fletcher	117	3.52	1.00	412
Feb. 9*	Fletcher & Russell	112	3.56	0.70	399
Feb. 13*	R. H. Fletcher	115	3.61	0.80	424
Apr. 5	R. H. Fletcher	192	5.37	2.45	1,030
July 25	C. L. Chatfield	1,237	1.56	5.45	1,938
Sept. 2	C. L. Chatfield	507	1.81	2.55	916
1912 Apr. 5*	C. L. Chatfield	193	6.38	3.10	1,232
July 5	C. L. Chatfield	2,132	3.04	11.60	6,493
Aug. 22	C. L. Chatfield	1,094	1.35	4.05	1,477

*Ice conditions.

DISCHARGE OF GRAND RIVER NEAR KREMMLING FOR 1911

Drainage Area, 2,380 Square Miles. Altitude, 7,320 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	390	330	590	380	620	2,130	6,350	2,950	1,430	905	920	578	350	
2	378	360	502	380	860	1,900	7,100	3,400	1,360	905	1,070	650	402	
3	352	360	552	380	940	1,800	7,350	4,950	1,300	920	1,010	552	402	
4	365	370	452	390	1,100	1,980	7,000	5,050	1,270	950	950	528	340	
5	378	402	428	465	1,030	2,250	7,350	5,000	1,220	965	935	620	415	
6	390	428	428	552	980	2,730	7,500	5,850	1,160	935	1,200	515	370	
7	390	415	415	515	920	3,460	7,500	5,150	1,120	905	1,340	565	465	
8	390	465	402	550	720	4,150	7,850	4,380	1,080	875	1,180	605	502	
9	390	452	390	550	830	4,850	8,350	3,910	1,040	845	1,130	590	402	
10	390	465	370	550	920	5,400	8,300	3,480	1,040	815	1,020	620	478	
11	390	452	370	550	900	5,900	7,150	3,020	1,150	800	965	500	440	
12	380	452	390	550	840	4,500	6,900	2,760	1,360	785	920	400	415	
13	380	428	402	540	800	4,100	7,300	2,520	1,270	755	875	450	402	
14	380	415	402	540	720	4,450	6,850	2,520	1,160	755	845	565	415	
15	380	415	390	528	730	4,900	6,400	2,360	1,080	785	830	740	400	
16	370	415	370	578	700	5,550	7,000	2,310	1,040	875	815	755	400	
17	370	415	415	528	750	5,750	7,150	2,360	1,060	845	800	755	400	
18	370	428	380	478	780	5,950	6,750	2,420	1,060	785	800	710	400	
19	370	415	380	490	830	6,550	6,150	2,310	1,020	755	815	665	400	
20	360	390	380	578	980	6,200	6,400	2,250	1,010	740	800	710	400	
21	360	428	360	605	1,100	4,950	6,250	2,090	1,080	740	755	680	380	
22	360	415	350	605	1,300	4,150	6,300	2,310	1,290	740	830	620	380	
23	360	390	370	635	1,420	3,800	6,550	2,580	1,430	740	578	540	380	
24	350	390	370	605	1,620	3,800	6,550	2,250	1,680	725	680	500	380	
25	350	402	370	528	1,620	4,250	4,800	2,520	1,430	710	725	428	350	
26	350	440	380	465	1,620	5,050	4,150	1,860	1,290	695	680	428	350	
27	350	452	370	478	1,820	5,550	3,700	1,860	1,180	695	680	452	350	
28	340	452	370	502	2,220	5,150	3,500	1,750	1,080	710	680	440	350	
29	340	415	....	528	2,550	5,200	3,450	1,640	1,040	725	650	360	350	
30	340	502	....	635	2,330	5,500	3,200	1,560	995	740	665	340	350	
31	340	650	....	620	....	5,900	....	1,480	950	....	620	....	350	
Total	11,403	13,208	11,348	16,278	34,550	137,800	191,150	90,850	36,675	24,120	26,763	6,861	12,168	Year 1911
Mean	368	426	405	525	1,152	4,445	6,372	2,931	1,183	804	863	562	393	1,677
Maximum	390	650	590	635	2,550	6,550	8,350	5,850	1,680	965	1,340	755	502	8,350
Minimum	340	330	350	380	620	1,800	3,200	1,480	950	695	578	340	350	330
Run-off per square mile	0.155	0.179	0.170	0.221	0.484	1.868	2.677	1.232	0.497	0.338	0.363	0.236	0.165	0.705
Run-off, depth, inches	0.179	0.207	0.177	0.255	0.540	2.154	2.987	1.420	0.573	0.377	0.419	0.264	0.190	9.570
Run-off, acre-feet	22,618	26,198	22,508	32,287	68,529	273,322	379,141	180,198	72,744	47,841	53,084	33,443	24,135	1,213,430
Acre-feet per square mile	9.50	11.01	9.46	13.57	28.79	114.84	159.30	75.71	30.56	20.10	22.30	14.05	10.14	509.84

DISCHARGE OF GRAND RIVER NEAR KREMMLING FOR 1912

Drainage Area, 2,380 Square Miles. Altitude, 7,320 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	380	420	400	780	1,435	13,545	11,320	4,775	1,205	900	702	....	
2	430	425	400	825	1,670	....	10,170	4,430	1,150	900	688	....	
3	430	430	425	875	2,040	....	8,700	3,800	1,125	900	672	....	
4	410	425	425	925	1,830	....	7,595	3,215	1,090	900	695	....	
5	430	425	400	1,140	1,590	....	6,800	....	1,060	900	718	....	
6	430	430	425	1,125	1,420	....	6,400	....	1,025	900	710	....	
7	430	425	450	975	1,610	20,020	6,010	....	1,000	900	702	....	
8	495	430	430	1,025	2,040	....	6,400	....	988	912	702	....	
9	450	430	450	1,040	2,525	16,100	6,630	....	988	912	710	....	
10	450	430	430	1,060	2,555	14,220	6,570	....	1,060	900	848	....	
11	425	450	430	1,090	2,115	12,800	6,340	....	1,040	912	825	....	
12	425	450	425	1,025	1,970	11,925	6,230	....	1,010	925	795	....	
13	425	430	430	975	1,830	11,050	6,400	2,955	1,010	912	765	....	
14	425	425	425	755	1,610	10,100	6,455	....	1,025	900	848	....	
15	510	425	430	725	1,610	9,560	6,630	....	1,075	900	880	....	
16	425	425	450	718	1,690	8,765	6,400	....	1,075	900	815	....	
17	425	430	430	740	2,065	7,220	5,485	....	1,100	925	755	....	
18	425	430	450	748	3,020	6,120	5,050	1,750	1,110	925	732	....	
19	425	430	460	748	4,180	5,385	5,140	1,630	1,090	925	702	....	
20	430	425	455	755	4,685	5,000	5,050	1,530	1,060	988	718	....	
21	425	400	470	775	5,690	5,240	4,865	1,450	1,050	950	718	....	
22	430	425	485	740	7,160	6,010	4,640	1,420	1,030	962	732	....	
23	425	425	460	725	7,985	7,465	5,385	1,380	1,010	962	725	....	
24	450	425	450	732	8,375	9,360	5,000	1,295	1,000	925	718	....	
25	430	420	460	825	9,025	10,710	4,340	1,235	980	912	702	....	
26	430	400	475	890	9,765	11,180	4,260	1,205	960	912	695	....	
27	425	400	500	830	10,100	11,180	4,220	1,175	940	890	688	....	
28	430	425	550	975	8,960	11,655	5,095	1,175	920	900	680	....	
29	450	425	600	1,060	7,595	11,790	4,685	1,205	900	880	702	....	
30	430	....	650	1,235	8,635	11,655	4,510	1,235	900	848	688	....	
31	450	....	700	....	11,050	....	4,555	1,235	....	785	....	....	
Total	13,450	12,335	14,420	26,836	137,830	248,055	187,330	38,095	30,976	28,162	22,030	....	Period
Mean	434	425	465	894	4,446	10,335	6,043	2,005	1,033	908	734	....	2,396
Maximum	510	450	700	1,235	11,050	20,020	11,320	4,775	1,205	988	880	....	20,020
Minimum	380	400	400	718	1,420	5,000	4,220	1,175	900	785	672	....	380
Run-off per square mile	0.182	0.179	0.195	0.376	1.868	4.342	2.539	0.842	0.434	0.382	0.308	....	1.007
Run-off, depth, inches	0.210	0.193	0.225	0.420	2.154	3.875	2.927	0.595	0.484	0.440	0.344	....	11.872
Run-off, acre-feet	26,678	24,466	28,602	53,228	273,382	492,010	371,564	75,560	61,440	55,859	43,696	....	1,506,484
Acre-feet per square mile	11.21	10.28	12.02	22.36	114.87	206.73	156.12	31.75	25.82	23.47	18.36	....	632.98

NOTE.—Discharge estimated Jan. 1-Apr. 13.

GRAND RIVER AT GLENWOOD SPRINGS

This station, located at Glenwood Springs about one-fourth mile above the mouth of Roaring Fork, is maintained by the United States Geological Survey and the Central Colorado Power Company.

The equipment consists of a Friez automatic gauge and cable located under the State bridge.

Results at this station are usually good and hot water from nearby springs keeps the river open all winter.

DISCHARGE MEASUREMENTS OF GRAND RIVER AT GLENWOOD SPRINGS

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 5	Russell & Wimmer	420	1.61	3.20	679
Feb. 25	R. H. Fletcher	381	1.32	2.85	504
Mar. 9	Thos. Grieve, Jr.	609	2.13	4.05	1,300
Mar. 25	E. O. Christiansen	570	1.95	3.75	1,110
May 7	J. B. Stewart	1,220	5.20	6.76	6,340
June 14	W. B. Freeman	1,460	8.22	8.35	12,000
Sept. 25	G. H. Russell	543	2.02	3.85	1,100
Oct. 14	C. L. Chatfield	636	2.13	4.15	1,350
Dec. 19	O. M. Wimmer	437	1.62	3.45	707
1912 Feb. 2	C. L. Chatfield	451	1.46	3.34	658
Feb. 27	H. B. Waha	436	1.50	3.44	653
Apr 27	J. L. Mathias	611	2.28	4.07	1,400
May 24	J. L. Mathias	1,660	8.30	8.97	13,800
Sept. 25	R. H. Fletcher	667	2.47	4.28	1,650

DISCHARGE OF GRAND RIVER AT GLENWOOD SPRINGS FOR 1911

Drainage Area, 4,520 Square Miles. Altitude, 5,747 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	510	1,490	690	1,030	3,770	11,600	5,250	2,540	1,490	1,490	1,030	470	
2	....	510	1,030	690	1,240	3,390	13,400	5,250	2,380	1,490	1,780	1,030	470	
3	....	510	860	690	1,360	3,030	13,400	7,200	2,230	1,490	1,780	1,030	490	
4	....	550	790	660	1,490	3,030	13,400	8,450	2,080	1,490	1,630	860	600	
5	....	600	790	790	1,490	3,390	13,400	7,800	2,080	1,490	1,780	860	510	
6	....	690	755	860	1,780	4,560	14,300	9,150	1,930	1,490	2,380	1,030	510	
7	....	660	755	860	1,490	6,000	14,300	8,800	1,780	1,490	2,540	940	510	
8	....	660	660	1,030	1,240	7,200	15,200	7,500	1,780	1,490	2,380	860	510	
9	....	690	660	1,240	1,240	8,450	15,200	6,600	1,630	1,240	2,080	1,030	550	
10	....	755	600	1,360	1,240	9,500	15,200	6,000	1,490	1,240	1,780	1,030	660	
11	....	860	660	1,240	1,240	9,900	13,800	5,500	1,780	1,240	1,780	1,030	860	
12	....	790	755	1,240	1,240	7,800	13,400	5,000	2,080	1,240	1,490	940	720	
13	....	690	860	1,030	1,240	7,200	13,400	4,560	2,080	1,240	1,490	790	720	
14	....	720	790	860	1,130	7,800	12,500	4,560	1,930	1,240	1,360	940	660	
15	....	690	755	860	1,030	8,450	11,600	4,160	1,780	1,240	1,240	940	720	
16	....	720	755	860	1,030	9,900	13,000	4,160	1,630	1,360	1,240	940	720	
17	....	660	720	860	1,030	9,900	12,100	4,160	1,630	1,360	1,240	1,030	720	
18	....	660	720	1,030	1,030	10,700	11,600	4,160	1,630	1,240	1,240	1,030	790	
19	....	660	690	940	1,240	11,600	11,600	4,160	1,490	1,240	1,240	1,030	660	
20	....	660	690	860	1,240	11,200	11,600	4,160	1,490	1,130	1,240	1,030	660	
21	....	660	660	860	1,630	8,800	12,100	3,770	1,490	1,130	1,030	1,130	660	
22	....	600	600	1,030	1,930	7,500	11,600	3,770	2,080	1,240	940	1,240	660	
23	....	600	600	1,030	2,380	6,900	11,600	4,360	2,380	1,240	1,030	1,130	660	
24	....	550	630	1,030	2,700	7,200	9,900	4,360	2,700	1,240	1,030	1,030	660	
25	....	660	690	1,030	2,700	7,800	8,800	3,770	2,700	1,030	1,030	860	690	
26	....	755	660	1,030	2,700	9,500	7,800	3,580	2,380	1,030	1,030	470	720	
27	....	720	660	940	3,030	9,900	6,600	3,390	2,080	1,030	1,030	690	720	
28	....	755	690	860	3,390	9,900	6,000	3,390	1,780	1,130	1,030	575	720	
29	....	790	....	860	4,160	9,900	6,000	3,030	1,780	1,130	1,130	470	720	
30	....	1,030	....	940	4,160	10,300	5,500	2,860	1,630	1,240	1,130	450	755	
31	....	1,360	....	940	....	10,700	....	2,700	1,490	....	1,030	....	755	
Total	....	21,725	20,975	29,200	53,830	245,170	349,900	155,560	59,930	38,370	44,620	27,445	20,230	Year 1911
Mean	....	701	749	942	1,794	7,909	11,663	5,018	1,933	1,279	1,439	915	653	2,923
Maximum	....	1,360	1,490	1,360	4,160	11,600	15,200	9,150	2,700	1,490	2,540	1,240	860	15,200
Minimum	....	510	600	660	1,030	3,030	5,500	2,700	1,490	1,030	940	450	470	450
Run-off per square mile	....	0.130	0.139	0.174	0.332	1.465	2.160	0.929	0.358	0.237	0.266	0.169	0.121	0.541
Run-off, depth, inches	....	0.150	0.145	0.201	0.370	1.689	2.410	1.071	0.413	0.264	0.307	0.189	0.140	7.344
Run-off, acre-feet	....	43,092	41,604	57,918	106,772	486,295	694,027	308,553	118,871	76,104	88,504	54,437	40,126	2,116,304
Acre-feet per square mile	....	9.53	9.20	12.81	23.62	107.60	153.55	68.26	26.30	16.84	19.58	12.04	8.88	468.21

DISCHARGE OF GRAND RIVER AT GLENWOOD SPRINGS FOR 1912

Drainage Area, 4,520 Square Miles. Altitude, 5,747 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	720	720	790	940	2,380	19,200	19,200	7,200	1,930	1,630	1,240	...	
2	720	690	790	860	2,860	18,200	17,200	7,200	1,780	1,630	860	...	
3	720	720	860	940	3,210	18,200	15,200	6,000	1,780	1,630	415	...	
4	690	575	860	1,130	3,580	21,800	13,400	5,500	1,630	1,490	450	...	
5	720	860	860	1,360	3,030	26,900	11,600	5,000	1,630	1,490	470	...	
6	720	720	940	1,490	2,700	29,300	10,700	4,560	1,490	1,490	470	...	
7	720	690	790	1,630	2,540	29,300	9,900	4,160	1,490	1,490	490	...	
8	825	720	755	1,490	3,030	30,500	10,700	3,960	1,490	1,490	470	...	
9	755	720	755	1,490	3,960	31,700	10,700	3,770	1,490	1,490	725	...	
10	755	720	630	1,630	4,560	30,500	10,700	3,770	1,630	1,490	980	...	
11	825	755	860	1,780	4,360	26,900	10,700	3,390	1,630	1,490	1,240	...	
12	790	860	790	1,490	3,770	23,500	9,900	3,030	1,630	1,490	1,360	...	
13	790	860	790	1,630	3,390	21,300	9,900	2,860	1,630	1,630	1,490	...	
14	790	690	720	1,360	3,030	19,200	9,900	2,700	1,630	1,490	1,240	...	
15	860	790	660	1,240	2,860	17,700	10,700	2,700	1,780	1,490	1,240	...	
16	755	755	660	1,240	3,030	16,200	9,900	2,700	1,780	1,630	1,030	...	
17	790	755	660	1,240	3,390	13,800	9,150	2,700	1,780	1,360	790	...	
18	790	755	720	1,240	4,560	12,000	8,100	2,700	1,780	1,360	1,130	...	
19	790	790	755	1,360	6,300	10,700	7,800	2,230	1,780	1,360	1,030	...	
20	860	690	720	1,490	7,800	9,900	7,800	2,380	1,780	1,360	790	...	
21	690	660	1,030	1,360	9,150	9,900	7,800	2,380	1,630	1,360	860	...	
22	860	755	790	1,240	11,600	11,600	7,200	2,380	1,630	1,360	940	...	
23	755	860	790	1,240	12,500	13,400	7,800	2,080	1,780	1,360	940	...	
24	790	940	790	1,240	13,400	15,700	8,450	2,080	1,490	1,240	860	...	
25	755	690	860	1,240	16,200	18,200	7,200	2,080	1,630	1,360	860	...	
26	720	790	860	1,630	17,700	19,200	6,600	1,930	1,630	1,360	720	...	
27	860	790	860	1,780	18,200	19,700	6,600	1,780	1,630	1,360	720	...	
28	630	790	790	1,780	16,200	19,700	7,200	1,780	1,630	1,360	720	...	
29	940	755	860	1,930	14,300	20,800	7,800	1,780	1,630	1,360	790	...	
30	720	...	940	1,930	15,700	20,200	7,200	2,080	1,630	1,360	600	...	
31	690	...	1,030	...	19,200	...	7,200	2,080	...	1,360	...	...	
Total	23,795	21,865	24,965	42,400	238,490	595,200	304,200	100,940	49,850	44,820	25,920	...	Period
Mean	768	754	805	1,413	7,693	19,840	9,813	3,256	1,662	1,446	864	...	4,395
Maximum	940	940	1,030	1,930	19,200	31,700	19,200	7,200	1,930	1,630	1,490	...	31,700
Minimum	630	575	630	860	2,380	9,900	6,600	1,780	1,490	1,240	415	...	415
Run-off per square mile	0.170	0.167	0.178	0.313	1.702	4.390	2.171	0.720	0.368	0.320	0.191	...	0.972
Run-off, depth, inches	0.196	0.180	0.205	0.349	1.962	4.898	2.503	0.830	0.411	0.369	0.213	...	12.110
Run-off, acre-feet	47,197	43,370	49,518	84,100	473,045	1,180 579	603,380	200,214	98,877	88,900	51,411	...	2,920 594
Acre-feet per square mile	10.44	9.60	10.96	18.60	104.65	261.20	133.50	44.29	21.88	19.67	11.37	...	646.15

GRAND RIVER NEAR PALISADES

This station is located at a steel bridge two miles above Palisades, and is maintained by the United States Geological Survey and the United States Reclamation Service.

The equipment consists of a chain gauge located on the bridge from which measurements are made.

The section at this station is permanent, but the velocities during flood stages are high and bridge piers interfere with the accuracy of results.

DISCHARGE MEASUREMENTS OF GRAND RIVER NEAR PALISADES

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Mar. 9	C. L. Chatfield	881	2.46	13.08	2,170
	Mar. 24	E. O. Christiansen	788	2.28	12.75	1,800
	May 10	S. O. Harper	2,690	5.80	18.30	15,600
	July 18	S. O. Harper	1,640	4.17	15.45	6,830
	Aug. 23	Harper & Page	1,150	2.80	13.65	3,220
	Sept. 28	Hoag & Page	1,070	2.20	13.20	2,360
	Oct. 16	C. L. Chatfield	1,110	2.45	13.60	2,720
1912	Apr. 27	Harper & Page	974	2.77	13.50	2,700
	May 18	Harper & Page	2,055	5.42	16.70	11,125
	June 7	Harper & Page	4,420	9.09	23.25	40,158
	July 10	Harper & Page	2,811	6.69	18.80	18,796
	Aug. 29	J. C. Page	999	2.52	13.35	2,517
	Sept. 7	Mills & Page	902	2.52	13.10	2,282
	Oct. 16	E. H. Swett	975	2.61	13.32	2,543

DISCHARGE OF GRAND RIVER NEAR PALISADES FOR 1911

Drainage Area, 8,550 Square Miles. Altitude, 4,730 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	1,370	1,150	3,440	1,220	1,830	6,060	18,100	10,400	4,350	3,110	3,970	2,090	....	
2	1,370	1,150	2,360	1,320	2,090	5,170	20,400	9,770	3,610	3,110	4,350	2,090	....	
3	1,320	1,150	1,960	1,100	2,500	4,750	20,800	9,770	3,270	2,650	3,970	2,090	....	
4	1,370	1,150	1,960	1,220	2,650	4,960	21,800	14,300	2,950	2,090	3,270	1,830	....	
5	1,320	1,250	1,830	1,590	2,950	5,830	22,300	13,100	2,650	1,830	9,770	1,830	....	
6	1,280	1,250	1,710	1,830	3,270	7,020	22,800	14,700	2,650	1,960	8,060	1,960	....	
7	1,280	1,400	1,590	2,360	2,950	9,470	23,800	16,400	2,500	1,960	6,060	1,830	....	
8	1,280	1,400	1,480	2,090	2,650	11,300	23,800	13,900	2,360	1,830	5,170	1,830	....	
9	1,280	1,400	1,420	2,220	2,500	15,600	24,300	11,300	2,360	1,710	4,750	1,830	....	
10	1,280	1,450	1,270	3,610	2,360	16,400	24,800	10,400	2,360	1,590	4,350	1,830	....	
11	1,480	1,500	1,270	3,790	2,360	14,700	22,800	9,470	2,500	1,710	3,790	2,090	....	
12	1,530	1,500	1,370	2,800	2,360	12,700	21,800	8,330	2,650	1,710	3,270	2,220	....	
13	1,420	1,590	1,420	2,090	2,360	11,700	22,800	7,530	2,360	1,590	2,950	1,960	....	
14	1,370	1,480	1,370	1,960	2,360	12,000	21,800	7,020	2,500	1,710	2,800	2,090	....	
15	1,320	1,590	1,320	1,830	1,960	12,400	21,800	6,530	2,360	1,830	2,800	1,960	....	
16	1,280	1,590	1,270	1,590	1,590	13,900	22,300	6,530	2,090	2,090	2,800	2,090	....	
17	1,280	1,370	1,220	1,590	1,370	15,600	20,400	7,020	2,220	1,830	2,650	2,090	....	
18	1,280	1,420	1,270	1,590	1,590	17,200	19,900	6,530	2,090	2,090	2,650	1,830	....	
19	1,120	1,270	1,220	1,590	2,090	17,200	19,900	6,770	2,090	1,830	2,650	2,090	....	
20	1,050	1,270	1,180	1,590	2,360	17,200	19,900	6,770	2,220	1,830	2,500	2,090	....	
21	1,230	1,220	1,100	1,590	2,500	13,900	19,900	6,060	2,800	1,830	2,360	2,090	....	
22	1,150	1,220	1,100	1,590	2,950	11,700	19,400	7,270	2,360	1,960	2,090	1,830	....	
23	1,150	1,180	1,030	1,830	3,610	11,700	19,000	8,610	2,950	1,830	2,090	1,830	....	
24	1,080	1,220	1,100	1,830	3,790	11,000	19,000	8,060	3,270	2,090	1,960	1,830	....	
25	1,150	2,360	1,140	1,830	4,350	13,500	18,100	6,770	3,440	1,960	2,090	1,830	....	
26	1,150	2,090	1,180	1,830	4,350	15,600	18,100	6,530	3,270	2,360	2,090	1,830	....	
27	1,150	1,960	1,180	1,590	4,960	16,400	13,900	5,830	2,800	2,090	2,090	1,590	....	
28	1,150	2,090	1,270	1,590	5,610	17,700	12,400	5,610	2,650	2,360	2,090	1,590	....	
29	1,150	2,220	....	1,590	6,530	18,600	11,000	5,170	2,220	2,360	2,360	1,710	....	
30	1,150	2,360	....	1,590	6,770	16,400	10,400	4,750	2,090	3,270	2,090	1,700	....	
31	1,150	2,800	....	1,830	....	17,200	....	4,350	1,960	....	2,090	....	....	
Total	38,940	48,050	41,030	57,670	91,570	394,860	597,500	265,550	81,950	62,170	105,980	57,550	....	Period 1911
Mean	1,256	1,550	1,465	1,860	3,052	12,737	19,917	8,566	2,644	2,072	3,419	1,918	....	5,400
Maximum	1,530	2,800	3,440	3,790	6,770	18,600	24,800	16,400	4,350	3,270	9,770	2,220	....	24,800
Minimum	1,050	1,150	1,030	1,100	1,370	4,750	10,400	4,350	1,960	1,590	1,960	1,590	....	1,030
Run-off per square mile	0.147	0.181	0.171	0.218	0.357	1.491	2.331	1.002	0.309	0.242	0.400	0.224	....	0.632
Run-off, depth, inches	0.170	0.209	0.178	0.251	0.398	1.719	2.601	1.155	0.356	0.270	0.461	0.250	....	7.850
Run-off, acre-feet	77,237	95,307	81,383	114,389	181,629	783,205	1,185,142	526,718	162,548	123,314	210,212	114,151	....	3,577 995
Acre-feet per square mile	9.03	11.15	9.52	13.38	21.25	91.67	138.69	61.65	19.02	14.43	24.60	13.35	....	418.79

DISCHARGE OF GRAND RIVER NEAR PALISADES FOR 1912

Drainage Area, 8,550 Square Miles. Altitude, 4,730 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	1,320	2,340	4,260	32,000	28,900	12,200	3,280	2,340	2,480	....	
2	....	....	1,320	2,080	5,380	31,500	27,300	11,500	2,930	2,340	2,340	....	
3	....	....	1,420	2,340	5,850	32,500	24,300	10,200	2,480	2,340	2,210	....	
4	....	....	1,590	2,620	5,380	36,700	23,200	9,300	2,340	2,210	2,080	....	
5	....	....	1,830	2,930	5,850	40,000	21,300	8,170	2,480	2,480	2,210	....	
6	....	....	1,950	2,930	5,850	42,200	17,600	7,630	2,480	2,340	2,340	....	
7	....	....	2,340	2,930	4,920	42,200	16,700	6,840	2,340	2,480	2,340	....	
8	....	....	1,830	2,770	5,850	41,100	18,900	6,340	2,210	2,620	2,210	....	
9	....	....	1,590	2,930	7,360	43,400	19,900	5,610	2,080	2,620	2,080	....	
10	....	....	1,590	3,280	8,170	43,400	18,900	5,380	2,080	2,930	2,210	....	
11	....	....	1,830	3,280	8,450	39,400	18,500	6,340	2,210	2,620	2,340	....	
12	....	....	1,710	2,930	8,450	35,100	17,200	4,920	2,080	2,620	2,340	....	
13	....	....	1,590	2,930	7,360	33,000	16,700	4,480	2,210	2,620	2,210	....	
14	....	....	1,420	2,620	6,340	30,400	20,300	4,050	2,210	2,620	2,340	....	
15	....	....	1,420	2,620	5,850	27,300	22,300	4,700	2,340	2,620	2,340	....	
16	....	....	1,420	2,340	6,840	25,800	18,900	4,920	2,620	2,620	2,210	....	
17	....	....	1,590	2,340	8,450	23,200	17,200	5,150	2,340	2,340	1,950	....	
18	....	2,340	1,370	2,340	10,800	21,300	14,700	4,480	2,340	2,480	1,590	....	
19	....	2,080	1,270	2,340	15,500	18,500	12,500	4,050	2,480	2,480	1,950	....	
20	....	1,590	4,050	2,620	18,500	17,200	14,300	3,650	2,620	2,340	1,830	....	
21	....	1,320	3,100	2,620	23,700	17,600	13,600	3,650	2,620	2,210	1,590	....	
22	....	1,270	1,950	2,480	26,800	19,900	13,200	3,280	2,620	2,340	1,830	....	
23	....	1,420	1,590	2,620	27,300	22,800	12,900	3,280	2,480	2,340	1,830	....	
24	....	1,370	1,590	2,620	28,400	24,200	19,400	2,930	2,480	2,340	1,590	....	
25	....	1,320	1,590	2,340	31,000	27,800	12,200	2,770	2,480	2,210	1,590	....	
26	....	1,420	2,080	2,620	33,000	30,400	11,800	2,620	2,620	2,340	1,830	....	
27	....	1,370	1,830	2,770	33,600	30,400	11,200	2,930	2,480	2,770	1,830	....	
28	....	1,320	1,590	2,930	31,500	29,900	13,200	2,770	2,480	3,460	1,590	....	
29	....	1,270	1,420	3,280	28,400	29,400	13,600	2,930	2,480	2,770	1,590	....	
30	....	....	1,480	3,650	31,500	30,400	12,200	3,100	2,480	2,620	1,590	....	
31	....	....	1,830	....	32,500	....	11,500	9,010	....	2,620	....	....	
Total	....	18,090	54,500	81,440	483,110	918,500	534,400	169,180	73,370	78,080	60,460	....	Period
Mean	....	1,508	1,758	2,715	15,584	30,617	17,239	5,457	2,446	2,519	2,015	....	8,610
Maximum	....	2,340	4,050	3,650	33,600	43,400	28,900	12,200	3,280	3,460	2,480	....	43,400
Minimum	....	1,270	1,270	2,080	4,260	17,200	11,200	2,620	2,080	2,210	1,590	....	1,270
Run-off per square mile	....	0.176	0.206	0.318	1.824	3.583	2.017	0.639	0.286	0.295	0.236	....	1.008
Run-off, depth, inches	....	0.078	0.238	0.355	2.103	3.997	2.325	0.737	0.319	0.340	0.263	....	10.759
Run-off, acre-feet	....	35,882	108,101	161,536	958,249	1,821,845	1,059 982	335,568	145,529	154,872	119,922	....	4,901 487
Acre-feet per square mile	....	4.20	12.65	18.90	112.12	213.18	124.02	39.26	17.03	18.12	14.03	....	573.54

WILLIAMS FORK OF GRAND RIVER NEAR SULPHUR SPRINGS

This station is located at a wagon bridge on F. A. Field's ranch, about nine miles southwest of Sulphur Springs and about four miles above the mouth of the river.

The equipment consists of a staff gauge bolted to middle pier of wagon bridge.

The bed of the stream is composed of small and medium sized boulders and is permanent.

The observer is F. A. Field, who is paid $5.00 per month.

DISCHARGE MEASUREMENTS OF WILLIAMS FORK OF GRAND RIVER NEAR SULPHUR SPRINGS

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 18	R. H. Fletcher	36	1.17	2.98	42
Feb. 13	R. H. Fletcher	54	1.04	3.08	56
Apr. 4	R. H. Fletcher	58	1.42	3.25	82
July 28	C. L. Chatfield	90	1.53	3.60	135
Sept. 4	C. L. Chatfield	75	1.21	3.38	91
1912 Apr. 4	C. L. Chatfield	54	1.15	3.10	62
May 22	C. L. Chatfield	121	4.07	4.34	493
July 12	C. L. Chatfield	140	4.88	4.50	683
Aug. 24	C. L. Chatfield	87	1.60	3.48	139

DISCHARGE OF WILLIAMS FORK RIVER NEAR SULPHUR SPRINGS FOR 1911

Drainage Area, 198 Square Miles. Altitude, 7,800 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	58	44	51	50	62	111	556	277	125	80	86	75	60	
2	58	44	51	50	64	105	580	472	113	83	79	74	60	
3	60	45	48	52	68	97	572	465	113	83	75	52	60	
4	58	47	47	50	81	103	588	389	115	99	74	58	60	
5	58	48	45	52	74	118	580	556	103	82	88	56	60	
6	58	45	48	52	71	210	604	502	95	82	128	56	60	
7	58	44	45	52	64	234	604	439	92	80	125	54	60	
8	60	45	47	52	64	290	665	372	90	79	103	54	60	
9	58	46	50	58	64	286	665	335	92	75	90	56	60	
10	62	47	50	58	68	330	665	286	83	72	86	58	60	
11	62	50	52	61	64	242	620	272	105	70	80	58	60	
12	58	49	51	57	61	218	620	250	107	70	92	58	60	
13	50	47	56	56	54	218	620	238	95	74	80	80	60	
14	49	45	53	57	51	286	556	226	95	78	88	78	60	
15	44	43	52	61	64	305	540	218	92	92	79	80	60	
16	46	43	52	63	62	345	556	210	86	78	79	78	60	
17	46	44	52	57	61	345	502	242	86	73	78	74	60	
18	44	41	52	57	58	372	518	242	80	67	78	78	60	
19	44	43	50	61	62	432	465	230	83	68	80	78	60	
20	44	47	47	62	58	400	502	202	82	68	78	80	60	
21	50	47	47	64	92	372	518	191	107	68	80	80	60	
22	50	43	50	64	105	345	620	180	99	68	79	78	60	
23	50	44	52	62	115	242	502	230	162	67	79	74	60	
24	58	44	50	62	117	230	432	180	125	66	80	68	60	
25	54	45	52	61	104	305	389	166	111	67	78	60	60	
26	54	49	49	57	98	345	389	146	97	70	78	60	60	
27	50	47	49	74	118	345	356	153	92	69	78	60	60	
28	50	45	50	62	153	372	320	146	89	68	80	60	60	
29	52	49	....	85	146	372	295	146	84	69	80	60	60	
30	54	53	....	62	115	432	272	135	82	89	79	60	60	
31	54	55	....	64	....	465	....	125	80	....	68	....	60	
Total	1,651	1,428	1,398	1,835	2,438	8,872	15,671	8,221	3,060	2,254	2,605	1,995	1,860	Year 1911
Mean	53	46	50	59	81	286	522	265	99	75	84	66	60	141
Maximum	62	55	56	85	153	465	665	556	162	99	128	80	60	665
Minimum	44	41	45	50	51	97	272	125	80	66	68	52	60	41
Run-off per square mile	0.269	0.233	0.252	0.299	0.421	1.444	2.636	1.338	0.498	0.379	0.424	0.336	0.303	0.715
Run-off, depth, inches	0.310	0.269	0.262	0.345	0.470	1.665	2.941	1.543	0.574	0.423	0.489	0.375	0.349	9.705
Run-off, acre-feet	3,284	2,832	2,773	3,640	4,835	17,597	31,083	16,306	6,070	4,470	5,167	3,957	3,689	102,419
Acre-feet per square mile	16.59	14.30	14.01	18.38	24.42	88.87	156.98	82.35	30.66	22.58	26.10	19.98	18.63	517.26

DISCHARGE OF WILLIAMS FORK RIVER NEAR SULPHUR SPRINGS FOR 1912

Drainage Area, 198 Square Miles. Altitude, 7,800 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	58	54	55	55	97	665	1,120	587	114	102	62	....	
2	58	52	56	55	108	665	1,070	501	112	97	62	....	
3	61	52	55	61	130	805	970	397	108	98	91	....	
4	61	51	54	61	114	1,000	870	373	108	100	79	....	
5	61	51	51	62	104	1,110	870	331	102	100	82	....	
6	61	49	54	81	118	1,160	667	325	100	98	60	....	
7	62	54	55	82	116	1,110	685	280	97	98	80	....	
8	62	51	54	75	128	1,270	822	280	94	92	73	....	
9	64	52	52	95	172	1,160	730	259	97	97	70	....	
10	58	52	51	67	169	1,110	775	243	112	97	78	....	
11	55	54	52	71	135	1,000	730	235	112	94	74	....	
12	55	54	52	67	107	1,000	685	221	108	97	79	....	
13	55	54	54	63	99	1,060	676	214	108	91	72	....	
14	56	55	54	61	89	955	685	204	112	88	61	....	
15	56	58	54	58	92	855	649	200	112	88	66	....	
16	55	55	54	69	90	870	685	200	116	88	68	....	
17	55	55	55	62	125	870	631	188	116	84	60	....	
18	54	55	54	63	234	775	649	191	112	94	61	....	
19	56	55	54	67	295	667	613	176	114	94	158	....	
20	54	56	52	61	340	649	563	165	112	92	58	....	
21	52	56	54	55	439	622	515	155	114	94	73	....	
22	58	55	54	57	548	667	487	150	110	76	59	....	
23	59	55	54	60	518	822	501	142	112	88	70	....	
24	54	55	52	64	525	970	547	140	112	88	70	....	
25	54	54	54	69	580	1,240	515	130	112	79	78	....	
26	55	54	52	64	604	1,180	473	122	108	90	65	....	
27	55	55	52	64	580	1,180	439	122	108	88	50	....	
28	54	55	52	67	465	1,180	459	132	108	95	52	....	
29	54	55	52	75	525	1,240	459	130	104	82	56	....	
30	54	....	54	82	620	1,120	515	132	104	76	53	....	
31	54	....	62	....	805	....	439	122	....	82	....	....	
Total	1,756	1,563	1,664	1,993	9,071	28,977	20,494	7,047	3,258	2,827	2,120	....	Period
Mean	57	54	54	66	293	966	661	227	109	91	71	....	241
Maximum	64	58	62	95	805	1,270	1,120	587	116	102	158	....	1,270
Minimum	52	49	51	55	89	622	439	122	94	76	50	....	49
Run-off per square mile	0.286	0.272	0.271	0.335	1.480	4.879	3.338	1.146	0.551	0.461	0.357	....	1.218
Run-off, depth, inches	0.330	0.293	0.312	0.374	1.706	5.444	3.849	1.321	0.615	0.532	0.398	....	15.174
Run-off, acre-feet	3,483	3,100	3,300	3,953	17,993	57,475	40,650	13,978	6,463	5,607	4,205	....	160,207
Acre-feet per square mile	17.59	15.66	16.67	19.96	90.87	290.28	205.30	70.60	32.64	28.32	21.24	....	809.13

ROARING FORK OF GRAND RIVER AT GLENWOOD SPRINGS

This station is located on a single span wooden highway bridge about four blocks west of Grand Avenue, Glenwood Springs, and about five hundred feet above the junction of Roaring Fork with Grand river.

The equipment consists of a chain gauge located on the bridge.

The bed of the stream is rough but fairly permanent.

The station is maintained by the United States Geological Survey and the United States Forest Service.

DISCHARGE MEASUREMENTS OF ROARING FORK OF GRAND RIVER AT GLENWOOD SPRINGS

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 20	O. M. Wimmer	130	2.56	1.05	333
	Feb. 21	O. M. Wimmer	132	2.65	1.05	349
	Feb. 25	R. H. Fletcher	172	2.47	1.18	426
	Mar. 11	Thos. Grieve, Jr.	218	2.78	1.55	607
	Apr. 1	O. M. Wimmer	211	3.00	1.61	639
	May 7	J. B. Stewart	546	5.66	3.55	3,090
	June 14	W. B. Freeman	885	8.78	5.70	7,770
	July 17	O. M. Wimmer	537	6.03	3.55	3,240
	Sept. 22	O. M. Wimmer	240	3.59	1.75	863
	Sept. 26	G. H. Russell	225	3.26	1.72	734
	Oct. 14	C. L. Chatfield	303	3.88	2.20	1,173
	Dec. 19	O. M. Wimmer	167	3.34	1.35	559
1912	Feb. 24	O. M. Wimmer	140	2.16	1.11	402
	Feb. 27	H. B. Waha	151	2.78	1.08	420
	May 18	J. L. Mathias	227	3.69	1.53	842
	May 25	J. L. Mathias	901	9.21	5.72	8,310
	Sept. 25	R. H. Fletcher	298	3.00	1.95	902

DISCHARGE OF ROARING FORK AT GLENWOOD SPRINGS FOR 1911

Drainage Area, 1,450 Square Miles. Altitude, 5,747 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	430	350	680	365	750	1,680					2,530	645	545	
2	430	350	420	365	790	1,500					2,040	698	610	
3	430	350	420	365	780	1,500					1,620	750	610	
4	430	350	420	392	770	1,620					1,270	935	645	
5	335	350	365	420	755	2,200					4,800	1,120	680	
6	405	350	365	480	740	3,250					3,620	865	610	
7	430	480	365	480	725	3,430					2,710	610	610	
8	430	480	365	480	715	4,400					2,370	750	540	
9	430	480	315	790	750	5,010					2,040	750	480	
10	430	540	365	750	750	4,400					1,710	750	510	
11	430	680	420	750	750	3,620					1,380	715	540	
12	430	450	420	510	715	3,250					1,270	662	480	
13	430	420	420	450	680	3,620					1,170	610	436	
14	430	420	365	450	645	4,050					1,170	715	392	
15	430	405	392	480	575	4,400				830	1,120	610	466	
16	400	390	392	480	645	4,400				843	1,080	610	540	
17	400	375	392	480	715	4,400				858	1,040	540	540	
18	400	360	365	480	680	4,800				790	990	575	540	
19	400	345	365	480	750	5,430				715	910	585	540	
20	400	330	340	480	950	4,000				772	1,040	595	480	
21	350	310	365	510	1,080	3,430				830	1,170	610	420	
22	350	290	352	540	1,270	3,250				790	1,080	610	450	
23	350	270	340	610	990	3,510				990	1,000	610	480	
24	350	365	380	575	1,500	3,770				910	910	540	510	
25	350	420	420	540	1,500	4,030				830	1,220	540	540	
26	300	420	365	510	1,560	4,290				910	990	592	420	
27	300	365	365	480	1,960	4,550				990	910	645	365	
28	300	365	365	480	2,120	4,800				990	830	505	488	
29	300	365		540	2,530	5,220				1,080	830	365	610	
30	290	540		610	2,040	5,300				2,040	680	480	575	
31	290	540		610		5,400					750		510	
Total	11,860	12,505	10,903	15,932	31,180	118,510				15,168	46,250	19,587	16,162	Period
Mean	383	403	389	514	1,039	3,823				948	1,492	653	521	1,105
Maximum	430	680	680	790	2,530	5,430				2,040	4,800	1,120	680	5,430
Minimum	290	270	315	365	645	1,500				715	680	365	365	270
Run-off per square mile	0.264	0.278	0.269	0.354	0.717	2.636				0.654	1.029	0.450	0.359	0.762
Run-off, depth, inches	0.304	0.320	0.280	0.408	0.800	3.039				0.389	1.186	0.502	0.414	7.340
Run-off, acre-feet	23,525	24,804	21,626	31,601	61,846	235,064				30,086	91,737	38,851	32,057	567,672
Acre-feet per square mile	16.22	17.10	14.92	21.80	42.65	162.10				20.69	63.26	26.79	22.11	391.47

DISCHARGE OF ROARING FORK AT GLENWOOD SPRINGS FOR 1912

Drainage Area, 1,450 Square Miles. Altitude, 5,747 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	440	370	390	435	1,750	7,270	5,840	3,270	1,370	820	820	....	
2	370	370	390	560	1,890	9,580	5,610	3,080	1,320	785	680	....	
3	410	370	435	650	2,120	10,100	5,380	2,980	1,270	785	785	....	
4	390	370	390	1,040	1,560	11,100	5,150	2,890	1,220	820	750	....	
5	370	370	390	990	1,620	12,500	5,840	2,710	1,170	820	761	....	
6	460	370	410	1,040	1,680	12,800	5,380	2,530	1,120	860	773	....	
7	460	410	390	990	1,500	12,500	5,840	2,360	1,070	900	785	....	
8	460	460	485	785	1,750	12,800	5,610	2,360	1,010	900	750	....	
9	535	410	390	990	2,040	12,500	5,380	2,360	945	860	785	....	
10	535	410	435	1,040	1,960	12,500	5,380	2,360	990	860	820	....	
11	535	390	435	1,120	1,680	11,100	5,150	2,360	945	820	785	....	
12	435	370	390	1,040	1,820	9,840	4,920	2,360	945	860	785	....	
13	510	370	410	860	1,620	9,840	5,380	2,530	900	900	785	....	
14	472	370	370	990	1,380	10,400	5,260	2,530	900	900	750	....	
15	435	390	370	945	1,380	9,840	5,150	2,360	922	820	680	....	
16	510	370	370	785	1,620	10,600	5,150	1,890	945	785	680	....	
17	510	410	390	680	2,360	9,320	4,920	1,960	900	785	650	....	
18	485	422	410	620	3,270	9,060	5,380	1,960	945	785	680	....	
19	460	435	460	590	4,260	9,320	5,150	2,120	945	785	650	....	
20	485	390	435	650	5,380	9,840	5,040	2,040	945	802	650	....	
21	428	330	510	785	5,840	9,840	4,920	1,750	900	820	680	....	
22	370	350	435	750	6,300	9,060	4,700	1,750	900	785	650	....	
23	410	410	535	785	6,780	8,800	4,920	1,820	860	785	620	....	
24	410	410	485	990	7,270	8,540	4,480	1,770	900	750	590	....	
25	410	370	435	1,040	8,020	8,800	4,480	1,720	900	750	560	....	
26	460	350	410	1,080	8,150	8,280	4,480	1,670	900	750	535	....	
27	435	370	410	1,040	8,280	8,280	4,480	1,620	900	785	560	....	
28	422	410	410	1,120	6,300	8,800	4,160	1,570	820	820	560	....	
29	410	330	410	1,220	7,770	9,060	3,850	1,520	860	750	560	....	
30	390	....	485	1,380	8,020	8,800	4,050	1,470	785	750	560	....	
31	380	....	435	....	9,840	....	3,650	1,420	....	785	....	....	
Total	13,792	11,157	13,105	26,990	125,210	301,070	155,080	67,090	29,502	25,182	20,679	....	Period
Mean	445	385	423	900	4,039	10,036	5,003	2,164	983	812	689	....	2,355
Maximum	535	460	535	1,380	9,840	12,800	5,840	3,270	1,370	900	820	....	12,800
Minimum	370	330	370	435	1,380	7,270	3,650	1,420	785	750	535	....	330
Run-off per square mile	0.307	0.266	0.292	0.621	2.786	6.918	3.450	1.492	0.678	0.560	0.475	....	1.624
Run-off, depth, inches	0.354	0.287	0.337	0.693	3.212	7.719	3.977	1.720	0.756	0.646	0.530	....	20.231
Run-off, acre-feet	27,356	22,130	25,994	53,535	248,354	597,172	307,600	133,073	58,517	49,948	41,017	....	1,564,698
Acre-feet per square mile	18.86	15.26	17.92	36.92	171.27	411.80	212.13	91.78	40.36	34.46	28.29	....	1,079,10

GUNNISON RIVER NEAR GUNNISON

This station is located on highway bridge about one mile below Gunnison.
The equipment consists of a chain gauge located on bridge from which measurements are made.
The bed of the stream is gravel and boulders, and shifts slightly.
The observer is Mrs. C. W. Chinery, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF GUNNISON RIVER NEAR GUNNISON

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Mar. 14	O. M. Wimmer	190	1.15	0.40	219
	June 17	O. M. Wimmer	610	6.28	3.10	3,830
	Aug. 14	B. S. Clayton	250	2.62	1.00	656
	Oct. 3	B. S. Clayton	284	3.32	1.22	941
	Nov. 22	B. S. Clayton	198	1.87	0.55	370
	Dec. 13	M. E. Bunger	171	1.70	0.50	291
1912	Feb. 2*	B. S. Clayton	152	1.70	2.45	258
	Mar. 15*	B. S. Clayton	134	1.64	1.08	220
	Apr. 22	B. S. Clayton	196	1.63	0.48	320
	May 17	C. C. Hezmalhalch	419	5.38	2.19	2,254
	July 23	C. C. Hezmalhalch	473	4.65	2.18	2,200
	Oct. 8	C. E. Turner	242	1.82	0.50	441
	Nov. 24	C. E. Turner	206	1.25	0.15	253

*Ice conditions.

DISCHARGE OF GUNNISON RIVER NEAR GUNNISON FOR 1911

Drainage Area, 1,014 Square Miles. Altitude, 7,673 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	
1		275	250	585	500			1,950	415	415	1,800	458	340	
2		225	250	500	585			2,750	415	415	890	542	378	
3		275	250	415	680			3,270	415	415	890	275	275	
4		275	250	340	680			2,750	340	340	1,250	275	378	
5		275	250	415	680			3,450		340	2,260	275	375	
6		275	250	415	585			3,090		340	1,800	340	350	
7		275	250	500	500			2,750		275	1,380	275	325	
8		275	225	585	415			2,420		275	1,120	275	300	
9		275	225	275	415			2,420		275	1,005	275	275	
10		275	225	340	500			2,580		415	1,062	275	275	
11		275	225	415	500			2,260		415	890	275	275	
12		275	225	340	585			2,100		415	785	275	275	
13		275	225	275	500			2,100		415	680	225	275	
14		275	225	340	415			1,950		340	585	225	275	
15		275	275	415	340			1,950		415	585	225	225	
16		275	225	500	415			1,655		415	500	225	225	
17		275	275	585	585		3,820	1,510		415	500	225	225	
18		250	340	500	680			1,380		340	500	225	225	
19		250	415	415	585			1,380	500	415	500	225	275	
20		250	415	415	500			1,250	500	415	500	275	275	
21		250	415	415	500		3,820	1,380		415	585	340	275	
22		250	415	500	585		4,200	1,380		415	585	275	275	
23		250	340	415	585		3,450	1,655		500	500	275	275	
24		250	275	340	500		2,920	1,510		500	542	275	275	
25		250	340	340	415		2,580			500	415	275	275	
26		250	340	415	500		2,260			500	340	275	275	
27		250	415	415	415		2,100		680	415	275	275	275	
28		250	500	415	500		2,100		585	415	225	340	275	
29		250		500	500		2,260		500	500	585	340	275	
30		250		500	500		1,350		415	1,655	632	340	275	
31		250		585					500		500		275	
Total		8,125	8,310	13,410	15,645		31,460	50,890	5,265	13,320	24,666	8,675	8,846	Period 1911
Mean		262	297	433	522		2,860	2,120	479	444	795	289	285	655
Maximum		275	500	585	680		4,200	3,450	680	1,655	2,260	542	378	4,200
Minimum		225	225	275	340		1,950	1,250	340	275	225	225	225	225
Run-off per square mile		0.258	0.293	0.427	0.515		2.767	2.091	0.472	0.438	0.784	0.285	0.281	0.646
Run-off, depth, inches		0.298	0.305	0.492	0.575		1.136	1.866	0.193	0.489	0.904	0.318	0.324	6.919
Run-off, acre-feet		16,110	16,495	26,593	31,026		62,395	100,936	10,443	26,415	48,925	17,209	17,524	374,106
Acre-feet per square mile		15.89	16.27	26.23	30.60		61.54	99.54	10.30	26.05	48.25	16.97	17.28	368.94

NOTE.—Ice conditions Jan. 1-Feb. 13; Dec. 2-31. Discharge estimated from measurements.

DISCHARGE OF GUNNISON RIVER NEAR GUNNISON FOR 1912

Drainage Area, 1,014 Square Miles. Altitude, 7,673 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	275	260	205	340	1,005	4,390	3,270	1,380	660	320	320	....	
2	275	260	210	340	1,120	4,780	2,580	1,250	615	320	320	....	
3	275	260	240	415	1,005	5,280	2,340	1,120	575	320	370	....	
4	275	250	205	500	890	5,580	2,260	1,005	540	320	320	....	
5	275	250	205	500	890	5,880	1,950	890	450	320	320	....	
6	260	250	200	500	785	5,880	1,655	785	420	320	280	....	
7	260	260	210	500	890	5,880	2,260	680	420	370	280	....	
8	260	240	210	542	1,250	5,480	1,950	680	420	420	240	....	
9	260	240	210	632	1,380	5,480	2,260	632	420	420	240	....	
10	260	230	205	680	1,380	5,380	1,950	585	420	420	280	....	
11	260	230	205	500	1,380	4,880	1,950	585	420	420	320	....	
12	250	230	205	378	1,800	4,390	2,260	542	420	420	180	....	
13	250	230	205	340	1,800	4,390	2,100	585	420	420	160	....	
14	250	230	215	308	1,950	4,200	1,800	680	370	420	180	....	
15	250	225	220	378	1,950	3,915	1,380	890	520	420	180	....	
16	250	225	225	340	2,180	3,450	1,380	785	470	370	180	....	
17	250	225	250	378	2,260	3,450	1,380	732	420	370	180	....	
18	240	230	275	415	3,270	3,180	1,510	680	420	320	180	....	
19	240	240	275	378	3,450	3,090	1,510	585	420	320	180	....	
20	240	240	300	340	3,820	3,090	1,655	525	420	320	180	....	
21	240	240	300	250	4,780	2,920	1,510	540	470	320	180	....	
22	240	240	320	275	4,780	2,920	1,510	455	420	320	180	....	
23	250	240	340	275	4,580	3,270	1,800	415	420	320	180	....	
24	250	245	415	308	4,200	3,820	1,510	430	370	280	180	....	
25	250	200	415	415	5,380	4,390	1,510	400	320	240	180	....	
26	250	200	415	340	4,390	4,010	1,655	455	320	240	180	....	
27	250	205	415	340	4,580	4,200	1,655	575	320	240	180	....	
28	250	205	340	415	4,295	4,010	1,510	485	320	280	180	....	
29	260	205	340	632	4,200	3,630	1,380	505	320	320	180	....	
30	260	....	340	732	4,980	3,820	1,380	575	320	320	180	....	
31	260	....	340	....	4,780	....	1,510	640	....	320	....	....	
Total	7,915	6,785	8,455	12,686	85,400	129,035	56,330	21,071	12,940	10,550	6,690	....	Period
Mean	255	234	273	423	2,755	4,301	1,817	680	431	340	223	....	1,068
Maximum	275	260	415	732	5,380	5,880	3,270	1,380	660	420	370	....	5,880
Minimum	240	200	200	250	785	2,920	1,380	400	320	240	160	....	160
Run-off per square mile	0.251	0.231	0.269	0.417	2.717	4.242	1.792	0.671	0.425	0.335	0.220	....	1.053
Run-off, depth, inches	0.289	0.249	0.310	0.465	3.132	4.733	2.066	0.774	0.474	0.386	0.245	....	13.123
Run-off, acre-feet	15,699	13,458	16,770	25,163	169,391	255,941	111,730	41,794	25,666	20,926	13,270	....	709,808
Acre-feet per square mile	15.48	13.27	16.54	24.82	167.05	252.41	110.19	41.22	25.31	20.64	13.09	....	700.02

NOTE.—Ice conditions Jan. 1-Mar. 22. Discharge estimated from measurements.

GUNNISON RIVER AT RIVER PORTAL

This station is located about twenty-one miles northeast of Montrose and about three hundred feet above the portal of the Gunnison tunnel.

The equipment consists of a staff gauge and a cable located a few feet down stream from gauge.

This station is maintained by the United States Reclamation Service. Computations are made by the engineers of the United States Geological Survey.

DISCHARGE MEASUREMENTS OF GUNNISON RIVER AT RIVER PORTAL

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Mar. 21	Christiansen & Swett	665	1.22	6.05	844
	May 9	E. H. Swett	1,890	4.25	12.40	8,040
	June 18	A. L. B. Moser	1,720	4.88	12.20	8,400
	July 9	A. L. B. Moser	1,310	4.30	10.00	5,620
	July 10	A. L. B. Moser	1,180	3.77	9.60	4,460
	July 16	A. L. B. Moser	1,080	3.57	9.05	3,850
	July 29	A. L. B. Moser	995	2.94	8.40	2,920
	Aug. 2	A. L. B. Moser	892	2.41	7.80	2,150
	Sept. 9	A. L. B. Moser	669	1.55	6.40	1,040
1912	May 23*	A. L. B. Moser	2,120	4.96	14.70	10,500
	July 10	Dolin & Swett	1,690	3.17	11.60	5,370
	Aug. 3	Barker & Swett	1,400	1.98	10.25	2,780
	Sept. 21	Lewy & Swett	1,100	0.91	8.00	992

*Measurement affected by diversion dam ¼ mile below the gauging station.

DISCHARGE OF GUNNISON RIVER AT RIVER PORTAL FOR 1911

Drainage Area, 4,140 Square Miles

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				1,720	3,380	8,410	4,780	2,420	1,180	3,000	1,180		
2				2,000	3,120	8,940	5,860	2,200	1,180	3,120	1,320		
3				2,000	3,250	8,940	7,020	2,200	1,180	2,530	1,250		
4				2,200	4,050	9,110	7,360	2,000	1,320	2,100	1,040		
5				1,900	5,390	9,640	6,350	1,900	1,180	2,200	1,180		
6				1,630	6,680	10,300	7,020	1,800	1,180	6,350	1,400		
7				1,470	7,360	10,300	6,680	1,630	1,040	4,480			
8				1,400	8,060	10,700	5,700	1,630	1,040	3,380			
9				1,470	8,940	11,200	5,080	1,470	985	3,000			
10				1,470	9,280	11,000	4,480	1,630	925	2,760			
11				1,320	7,190	11,200	3,910	1,800	985	2,420			
12				1,250	6,020	10,300	3,640	1,800	985	2,310			
13				1,180	6,180	10,300	3,910	1,800	1,040	2,200			
14				1,040	6,180	10,200	4,330	1,800	1,040	2,000			
15				1,040	6,680	9,640	3,910	1,630	1,110	1,900			
16				1,110	6,520	9,640	3,640	1,470	1,180	1,800			
17				1,320	6,850	8,760	3,640	1,470	1,040	1,630			
18				1,470	7,360	8,410	3,640	1,470	985	1,630			
19				1,630	8,410	8,580	3,910	1,320	985	1,550			
20				2,100	7,190	8,760	4,050	1,320	985	1,400			
21				2,420	5,700	8,760	4,190	1,320	1,040	1,180			
22				3,120	5,080	9,110	4,190	1,630	985	1,180			
23				3,380	5,390	8,410	5,080	2,000	1,040	1,320			
24				3,640	6,350	7,710	4,190	2,000	1,180	1,470			
25				3,380	6,850	6,850	3,640	1,800	1,040	1,400			
26				3,780	7,710	6,020	3,640	1,630	985	1,320			
27				4,480	7,360	5,540	3,510	1,470	1,110	1,470			
28				4,780	7,190	5,390	3,120	1,400	1,110	1,470			
29				5,240	7,360	5,390	2,880	1,320	1,110	1,470			
30				4,330	7,360	5,080	2,760	1,320	1,470	1,400			
31					7,710		2,640	1,180		1,180			
Total				69,270	202,150	262,590	138,750	51,830	32,615	66,620	7,370		Period
Mean				2,309	6,521	8,753	4,476	1,672	1,087	2,149	1,228		3,778
Maximum				5,240	9,280	11,200	7,360	2,420	1,470	6,350	1,400		11.200
Minimum				1,040	3,120	5,080	2,640	1,180	925	1,180	1,040		1,040
Run-off per square mile				0.558	1.575	2.114	1.081	0.404	0.263	0.519	0.297		0.913
Run-off, depth, inches				0.623	1.816	2.358	1.246	0.466	0.293	0.593	0.066		7.466
Run-off, acre-feet				137,397	400,965	520,848	275,210	102,804	64,691	132,141	14,618		1,648,674
Acre-feet per square mile				33.19	96.85	125.81	66.48	24.83	15.63	31.92	3.53		398.24

DISCHARGE OF GUNNISON RIVER AT RIVER PORTAL FOR 1912

Drainage Area, 4,140 Square Miles

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	......	......	......	1,800	4,900	10,300	7,280	3,280	1,050	750	750	......	
2	......	......	......	1,600	5,050	10,700	6,750	3,020	900	750	600	......	
3	......	......	......	1,700	4,750	11,500	6,220	2,780	825	750	600	......	
4	......	......	......	2,520	4,450	12,700	5,350	2,520	750	750	750	......	
5	......	......	......	2,780	3,280	12,700	4,750	2,280	900	750	750	......	
6	......	......	......	2,780	3,020	12,100	4,450	2,020	975	825	750	......	
7	......	......	......	2,520	3,280	11,500	4,750	1,800	475	825	675	......	
8	......	......	......	2,780	4,150	11,100	5,050	1,600	475	900	750	......	
9	......	......	......	3,280	5,050	11,500	4,900	1,400	475	825	825	......	
10	......	......	......	4,450	4,750	10,300	4,750	1,300	525	750	475	......	
11	......	......	......	4,150	4,750	9,900	4,750	1,200	600	825	275	......	
12	......	......	......	3,850	5,350	8,850	4,450	1,200	525	825	375	......	
13	......	......	......	3,280	4,900	8,150	4,450	1,200	475	900	275	......	
14	......	......	......	2,780	4,150	7,450	4,600	1,300	475	825	200	......	
15	......	......	......	2,520	4,150	7,800	4,750	1,600	750	825	200	......	
16	......	......	......	2,520	4,600	7,800	4,600	1,900	900	825	......	......	
17	......	......	......	2,780	6,050	7,450	4,150	1,700	900	825	......	......	
18	......	......	......	2,780	7,450	6,920	3,850	1,700	900	825	......	......	
19	......	......	......	2,650	8,500	6,400	3,700	1,400	900	825	......	......	
20	......	......	......	2,520	8,850	5,880	3,850	1,300	825	825	......	......	
21	......	......	......	2,280	9,900	6,050	3,550	1,120	900	825	......	......	
22	......	......	......	2,150	10,700	6,400	3,400	1,050	750	750	......	......	
23	......	......	......	2,150	10,300	7,450	4,000	975	750	750	......	......	
24	......	......	......	2,280	10,700	7,800	3,850	900	750	750	......	......	
25	......	......	......	3,020	11,500	8,500	4,000	825	750	750	......	......	
26	......	......	......	2,900	11,900	8,500	4,150	975	750	750	......	......	
27	......	......	......	2,780	11,100	8,150	3,850	1,120	750	750	......	......	
28	......	......	......	2,780	10,300	7,980	3,700	900	750	825	......	......	
29	......	......	......	3,550	10,700	7,800	3,550	600	750	825	......	......	
30	......	......	......	3,850	12,300	7,800	3,550	750	750	750	......	......	
31	......	......	......	......	11,900	......	3,550	1,050	......	825	......	......	
Total	......	......	......	83,780	222,730	267,430	138,550	46,765	22,250	24,750	8,250	......	Period
Mean	......	......	......	2,790	7,185	8,914	4,469	1,509	742	798	550	......	3,557
Maximum	......	......	......	4,450	12,300	12,700	7,280	3,280	1,050	900	825	......	12,700
Minimum	......	......	......	1,600	3,020	5,880	3,400	600	475	750	200	......	200
Run-off per square mile	......	......	......	0.674	1.735	2.153	1.080	0.364	0.179	0.193	0.133	......	0.859
Run-off, depth, inches	......	......	......	0.752	2.000	2.402	1.245	0.420	0.200	0.222	0.074	......	7.315
Run-off, acre-feet	......	......	......	166,178	441,785	530,448	274,814	92,759	44,133	49,092	16,363	......	1,615,572
Acre-feet per square mile	......	......	......	40.14	106.71	128.13	66.38	22.41	10.66	11.85	3.95	......	390.23

UNCOMPAHGRE RIVER AT OURAY

This station is located in the box canon on the edge of Ouray and just above the mouth of Canon creek. The equipment consists of a staff gauge. Measurements are made by wading.
The bed of the stream is composed of gravel and boulders and is shifting in character.
A pipe line for power plant diverts water above the station and empties below.
Records at this station were furnished by the United States Geological Survey.

DISCHARGE MEASUREMENTS OF UNCOMPAHGRE RIVER AT OURAY

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 25	O. M. Wimmer	11	0.53	0.20	6
Mar. 20	O. M. Wimmer	14	0.84	0.40	12
Sept. 3	O. M. Wimmer	22	1.97	1.80	43
Oct. 26	O. M. Wimmer	23	1.48	0.80	34
Dec. 18	H. B. Waha	16	0.86	0.45	14
1912 Mar. 20	J. L. Mathias	19	1.17	0.67	23
Apr. 21	H. B. Waha	11	0.89	0.30	9.4
June 14	H. B. Waha	....	....	2.10	215
Sept. 29	R. H. Fletcher	10	1.11	0.28	13

DISCHARGE OF UNCOMPAHGRE RIVER AT OURAY FOR 1911

Drainage Area, 44 Square Miles. Elevation, 7,710 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	12	10	68	53	325	191	110	32	277	32	12	
2	....	2	10	58	53	300	211	110	32	155	25	12	
3	....	4	10	43	53	300	254	110	32	124	25	12	
4	....	6.5	10	25	85	375	191	110	32	124	25	12	
5	....	4	16	25	139	475	191	108	32	*	32	12	
6	....	2	12	25	191	475	211	106	32	375	32	12	
7	....	2	6.5	20	172	450	191	104	25	300	32	10	
8	....	2	9	20	211	450	172	102	25	191	32	10	
9	....	2	6.5	20	211	450	172	100	25	124	32	10	
10	....	2	6.5	12	211	425	172	98	25	110	25	9	
11	....	4	6.5	18	155	425	155	97	25	97	20	9	
12	....	4	6.5	20	139	450	172	97	25	85	25	10	
13	....	2	9	12	139	450	525	85	25	74	32	10	
14	....	2	6.5	16	124	425	254	85	25	63	32	10	
15	....	2	4	12	124	400	277	74	25	53	25	10	
16	....	2	6.5	20	139	400	277	53	25	53	32	10	
17	....	2	9	32	172	375	277	53	25	53	20	14	
18	....	2	9	43	211	375	300	53	25	53	20	12	
19	....	2	9	53	232	350	277	43	25	43	20	12	
20	....	2	12	53	172	350	232	43	20	32	20	10	
21	....	4	12	63	139	325	191	43	25	25	16	10	
22	....	4	12	85	124	325	191	43	25	25	16	9	
23	....	4	14	97	139	300	191	43	32	20	14	7.8	
24	....	4	16	97	211	325	172	43	20	20	12	7.8	
25	6.5	4	12	85	254	277	172	43	20	20	12	7.8	
26	6.5	4	10	85	277	300	155	43	32	25	10	7.8	
27	2	4	10	110	232	277	139	43	43	32	10	9	
28	9	4	10	97	277	254	124	43	53	43	10	9	
29	7.8	....	14	110	277	232	124	43	85	43	12	9	
30	7.8	....	20	85	300	232	124	32	139	32	12	9	
31	9	....	43	....	350	....	110	32	....	32	....	9	
Total	48.6	94.5	347.5	1,509	5,560	10,872	6,395	2,192	1,011	2,703	662	313.2	Period
Mean	6.94	3.38	11.2	50.3	179.4	362.4	206.3	70.7	33.7	90.1	22.1	10.1	93.26
Maximum	9	12	43	110	350	475	525	110	139	375	32	14	525
Minimum	2	2	4	12	53	232	110	32	20	20	10	7.8	2
Run-off per square mile	0.158	0.077	0.255	1.143	4.077	8.236	4.689	1.607	0.766	2.048	0.502	0.230	2.120
Run-off, depth, inches	0.041	0.080	0.294	1.275	4.700	9.189	5.406	1.853	0.855	2.285	0.560	0.265	26.803
Run-off, acre-feet	96	187	689	2,993	11,028	21,565	12,684	4,347	2,005	5,361	1,313	621	62,889
Acre-feet per square mile	2.18	4.25	15.66	68.02	250.64	490.11	288.27	98.80	45.57	121.84	29.84	14.11	1,429.29

*Flood. Discharge for day omitted.

DISCHARGE OF UNCOMPAHGRE RIVER AT OURAY FOR 1912

Drainage Area, 44 Square Miles. Elevation, 7,710 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	9	2	2	9	53	400	300	133	40	13	14	......	
2	9	0	3	14	53	425	277	133	40	13	14	......	
3	9	0	4	12	43	525	236	119	32	13	14	......	
4	9	4	4	18	43	525	199	105	32	13	14	......	
5	10	4	4	14	43	525	164	80	20	13	12	......	
6	12	4	5.2	12	32	450	164	80	25	16	14	......	
7	10	5	6.5	20	47	375	181	80	25	16	14	......	
8	9	5.2	10	25	62	400	199	69	25	16	14	......	
9	7.8	6.5	3	32	77	450	217	59	22	16	14	......	
10	10	6.5	6.5	43	92	425	199	40	18	13	12	......	
11	9	6.5	9	25	107	400	199	49	20	20	14	......	
12	7.8	5.2	16	25	122	300	217	49	20	20	14	......	
13	6.5	4	3	20	137	236	199	40	20	32	14	......	
14	6.5	4	2	16	152	217	199	40	20	25	14	......	
15	7.8	6.5	2	11	167	256	181	25	20	20	12	......	
16	7.8	4	4	14	182	277	199	32	25	20	14	......	
17	7.2	1	4	12	197	256	181	40	25	20	14	......	
18	6.5	5.2	6.5	12	212	199	164	49	20	16	13	......	
19	6.5	5.2	7.8	12	227	181	164	49	20	16	13	......	
20	4	5.2	23	12	243	217	164	32	16	13	10	......	
21	4	5.2	12	8.5	259	256	164	32	16	16	10	......	
22	6.5	4	9	7.8	277	325	164	32	13	16	10	......	
23	6.5	3	5.2	6.5	325	350	148	25	13	16	9	......	
24	6.5	4	5.2	14	425	325	148	25	13	16	9	......	
25	5.2	4	9	18	425	350	133	20	10	16	6	......	
26	5.2	4	10	20	400	350	149	25	13	20	3	......	
27	5.2	3	6.5	19	425	350	165	25	13	25	3	......	
28	6.5	2	6.5	22	425	350	181	25	13	20	2.5	......	
29	5.2	0	7.8	28	475	400	199	32	13	20	2.5	......	
30	4	......	7.8	43	525	350	148	32	10	13	1.8	......	
31	2	......	8.5	......	425	......	148	40	......	16	......	......	
Total	221.2	113.2	213	544.8	6,677	10,445	5,750	1,616	596	538	324.8	......	Period
Mean	7.14	3.9	6.87	18.2	215	348.2	185.5	52.1	19.9	17.4	10.8	......	80.71
Maximum	12	6.5	23	43	525	525	300	133	40	32	14	......	525
Minimum	2	0	2	6.5	32	181	133	20	10	13	1.8	......	0
Run-off per square mile	0.162	0.089	0.156	0.414	4.895	7.914	4.216	1.184	0.452	0.395	0.245	......	1.834
Run-off, depth, inches	0.187	0.096	0.180	0.462	5.644	8.829	4.861	1.365	0.504	0.455	0.273	......	22.856
Run-off, acre-feet	439	224	422	1,081	13,244	20,718	11,405	3,205	1,182	1,067	644	......	53,631
Acre-feet per square mile	9.98	5.09	9.59	24.57	301.00	470.86	259.20	72.84	26.82	24.25	14.64	......	1,218.84

UNCOMPAHGRE RIVER NEAR FORT CRAWFORD

This station is located about two miles below Fort Crawford.

The equipment consists of a vertical staff gauge fastened to upstream side of a single span wooden highway bridge.

Measurements are made from the bridge.

This station has been maintained by the United States Reclamation Service. Computations were made by engineers of the United States Geological Survey.

A number of large irrigating ditches divert water above this station.

DISCHARGE MEASUREMENTS OF UNCOMPAHGRE RIVER NEAR FORT CRAWFORD

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Mar. 20	Christiansen & Swett	55	1.96	2.10	108
Apr. 18	E. H. Swett	42	2.70	2.10	112
Apr. 26	E. H. Swett	53	3.17	2.45	169
May 15	E. H. Swett	42	2.62	2.05	110
May 31	E. H. Swett	94	3.88	3.32	365
June 13	E. H. Swett	167	6.17	4.90	1,030
June 22	E. H. Swett	150	5.64	4.30	846
July 11	E. H. Swett	103	3.88	3.30	400
July 26	E. H. Swett	101	3.47	3.25	351
Aug. 23	E. H. Swett	98	3.55	3.12	348
Sept. 8	E. H. Swett	57	2.26	2.30	129
Sept. 11	E. H. Swett	59	2.29	2.32	135
Oct. 3	E. H. Swett	104	4.18	3.47	435

DISCHARGE OF UNCOMPAHGRE RIVER NEAR FORT CRAWFORD FOR 1911

Drainage Area, 497 Square Miles. Altitude, 6,170 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				174	66	378	412	362	107	1,120			
2				204	56	378	540	316	99	686			
3				184	47	395	777	184	103	560			
4				204	51	378	754	149	133	378			
5				162	110	580	664	166	128	1,120			
6				174	288	800	664	157	113	1,170			
7				149	166	777	686	166	128	920			
8				125	250	800	560	118	100	501			
9				118	275	944	501	110	81	446			
10				103	237	920	446	166	133	429			
11				71	125	968	395	193	119	395			
12				90	96	1,040	331	193	125	362			
13				79	110	920	848	226	118	331			
14				66	126	1,070	920	162	122	302			
15				51	141	600	708	160	149	275			
16				68	125	664	540	157	141	250			
17				110	157	600	412	144	133	226			
18				110	166	600	429	149	149	237			
19				128	174	800	686	174	138	237			
20				174	125	777	686	157	133	214			
21				162	96	664	580	157	130	204			
22				182	90	754	560	184	141	193			
23				197	90	686	560	302	141	193			
24				144	157	731	362	193	139	174			
25				144	378	708	275	174	128	174			
26				174	302	580	302	144	118	184			
27				180	184	560	378	128	154	214			
28				204	157	580	275	122	184	174			
29				197	237	540	262	109	193	193			
30				96	346	412	372	110	560	193			
31					412		482	110		174			
Total				4,224	5,340	20,604	16,367	5,342	4,340	12,229			Period
Mean				141	172	687	528	172	145	394			320
Maximum				204	412	1,070	920	362	560	1,170			1,170
Minimum				51	47	378	262	109	81	174			47
Run-off per square mile				0.284	0.346	1.382	1.061	0.346	0.292	0.793			0.643
Run-off, depth, inches				0.317	0.399	1.542	1.223	0.399	0.326	0.914			5.120
Run-off, acre-feet				8,379	10,592	40,868	32,464	10,596	8,609	24,256			135,764
Acre feet per square mile				16.86	21.31	82.23	65.32	21.36	17.32	48.81			273.21

UNCOMPAHGRE RIVER AT MONTROSE

This station is located at the iron highway bridge just west of Montrose and is maintained by the United States Reclamation Service.

The equipment consists of a staff gauge located about twenty feet upstream from the bridge.

DISCHARGE MEASUREMENTS OF UNCOMPAHGRE RIVER AT MONTROSE

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Mar. 21	Christiansen & Swett	46	2.49	2.95	114
	Apr. 12	E. H. Swett	39	1.98	2.70	77
	Apr. 28	E. H. Swett	57	3.08	3.12	174
	May 17	E. H. Swett	31	1.44	2.50	44
	May 19	E. H. Swett	46	2.65	3.00	122
	June 3	E. H. Swett	66	4.24	3.65	280
	June 13	E. H. Swett	162	5.70	5.40	922
	June 28	E. H. Swett	100	4.69	4.58	469
	July 18	E. H. Swett	75	3.90	3.75	292
	July 31	E. H. Swett	88	4.06	4.02	357
	Aug. 14	E. H. Swett	48	2.58	3.05	124
	Aug. 28	E. H. Swett	40	1.84	2.80	73
	Sept. 26	E. H. Swett	37	1.55	2.67	58
	Oct. 10	E. H. Swett	98	3.78	3.50	370
	Oct. 14	E. H. Swett	75	3.12	3.01	234
	Oct. 23	E. H. Swett	56	2.63	2.60	147
1912	Apr. 26	E. H. Swett	37	1.53	1.94	57
	May 23	E. H. Swett	193	6.14	5.03	1,180
	June 4	E. H. Swett	264	7.10	6.18	1,870
	June 18	E. H. Swett	69	3.23	3.30	223
	July 8	E. H. Swett	100	4.28	3.62	426
	July 22	E. H. Swett	131	5.16	4.15	676
	Aug. 2	E. H. Swett	74	3.25	3.10	240
	Aug. 6	E. H. Swett	29	0.66	1.80	19
	Aug. 30	E. H. Swett	35	2.69	2.54	94

DISCHARGE OF UNCOMPAHGRE RIVER AT MONTROSE FOR 1911

Drainage Area, 565 Square Miles. Altitude, 5,820 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					185	33	185	280	145	32	1,280			
2					198	27	240	480	238	27	730			
3					195	32	260	550	288	44	580			
4					215	57	260	530	262	61	440			
5					171	119	560	590	245	79	1,270			
6					155	222	595	530	135	60	1,220			
7					135	198	595	530	52	57	630			
8					123	185	670	450	25	37	440			
9					105	171	650	350	25	20	440			
10					96	131	790	380	75	35	367			
11					66	45	750	270	107	32	286			
12					62	25	875	275	99	29	265			
13					51	29	810	502	125	44	250			
14					31	20	875	830	99	57	228			
15					24	41	612	432	63	97	210			
16					25	26	630	432	40	72	189			
17					74	38	560	355	30	60	181			
18					69	35	398	300	22	60	177			
19					139	52	1,290	538	20	60	177			
20					155	40	1,840	595	39	63	169			
21					195	24	1,140	520	63	58	169			
22					190	12	1,360	415	79	66	161			
23					125	12	1,240	502	125	79	149			
24					105	82	1,050	415	79	75	145			
25					107	192	940	275	68	77	136			
26					185	175	500	300	52	83	138			
27					185	102	460	262	60	87	149			
28					175	52	360	212	60	95	153			
29					125	129	160	165	60	165	145			
30					75	181	50	188	52	391	142			
31						198		385	41		136			
Total					3,741	2,685	20,705	12,838	2,873	2,202	11,152			Period 1911
Mean					125	87	690	414	93	73	360			263
Maximum					215	222	1,840	830	288	391	1,280			1,840
Minimum					24	12	50	165	20	27	136			12
Run-off per square mile					0.221	0.153	1.221	0.733	0.164	0.130	0.637			0.465
Run-off, depth, inches					0.247	0.176	1.362	0.845	0.189	0.145	0.734			3.700
Run-off, acre-feet					7,420	5,326	41,068	25,464	5,698	4,371	22,120			111,465
Acre-feet per square mile					13.13	9.43	72.69	45.07	10.08	7.74	39.15			197.25

DISCHARGE OF UNCOMPAHGRE RIVER AT MONTROSE FOR 1912

Drainage Area, 565 Square Miles. Altitude, 5,820 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					201	970	1,030	280	75				
2					203	1,210	880	155	63				
3					173	1,510	820	108	68				
4					145	1,630	838	78	63				
5					161	1,630	690	8	52				
6					189	1,630	540	30	55				
7					225	1,090	295	55	60				
8					316	1,150	310	82	55				
9					280	1,120	346	128	68				
10					138	1,120	310	98	63				
11					108	1,120	280	68	68				
12					100	1,270	260	98	55				
13				165	82	750	280	98	58				
14				139	82	442	295	68	58				
15				121	92	362	250	87	75				
16				52	155	410	268	72	58				
17				22	470	334	310	82	55				
18				22	802	310	295	82	63				
19				25	760	255	340	78	68				
20				24	796	242	325	82	78				
21				26	1,160	242	325	82	60				
22				29	1,090	310	268	75	60				
23				31	1,120	515	310	75	68				
24				36	1,180	715	310	72	72				
25				46	1,330	850	355	55	55				
26				52	1,390	820	418	28	60				
27				50	1,270	880	430	35	68				
28				70	1,300	850	486	25	55				
29				130	1,330	838	450	50	75				
30				181	1,480	1,150	390	55	58				
31					1,300		328	82					
Total				1,220	19,428	25,725	13,032	2,471	1,889				Period
Mean				68	627	857	420	80	63				373
Maximum				181	1,480	1,630	1,030	280	78				1,630
Minimum				22	82	242	250	8	52				8
Run-off per square mile				0.120	1.110	1.517	0.743	0.141	0.112				0.660
Run-off, depth, inches				0.080	1.280	1.693	0.857	0.163	0.125				4.197
Run-off, acre-feet				2,420	38,535	51,025	25,849	4,901	3,747				126,478
Acre-feet per square mile				4.28	68.20	90.31	45.76	8.67	6.63				223.85

UNCOMPAHGRE RIVER NEAR DELTA

This station is located on the second highway bridge two miles south of Delta and near the junction of the Uncompahgre with the Gunnison river.

At ordinary stages the flow of the river at this point is nearly all seepage water from ditches above. During the irrigating season the ditches consume all the normal flow.

This station is maintained by the United States Reclamation Service.

DISCHARGE MEASUREMENTS OF UNCOMPAHGRE RIVER NEAR DELTA

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Apr. 20	E. H. Swett	52	1.41	2.11	74
May 4	E. H. Swett	60	1.94	2.39	117
May 25	E. H. Swett	51	1.92	2.30	98
July 7	E. H. Swett	105	3.73	3.40	392
July 21	E. H. Swett	143	4.23	3.44	605
Aug. 3	E. H. Swett	60	2.44	2.14	147
Aug. 30	E. H. Swett	41	1.20	1.71	49
Oct. 13	E. H. Sweet	151	3 38	2.84	511
1912 Apr. 19	E. H. Swett	80	1 16	1.57	93
May 11	E. H. Swett	126	2.21	2.32	278
May 28	E. H. Swett	288	5.62	3.85	1,620
June 6	E. H. Swett	299	5.46	3.73	1,630
July 24	E. H. Swett	167	3.59	2.28	600
Sept. 6	E. H. Swett	83	0.53	0.66	44

DISCHARGE OF UNCOMPAHGRE RIVER NEAR DELTA FOR 1911

Drainage Area, 1,130 Square Miles. Altitude, 4,970 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					192	155	62	135	187	36	1,240			
2					218	78	55	245	172	36	1,170			
3					230	92	70	470	172	44	810			
4					192	135	92	770	95	53	660			
5					192	205	192	538	44	53	1,140			
6					218	205	245	470	36	53	1,740			
7					230	372	275	410	36	80	1,130			
8					155	430	290	490	21	80	770			
9					145	560	355	370	21	80	673			
10					115	430	450	390	18	80	650			
11					92	290	560	255	44	90	583			
12					70	192	492	195	39	80	538			
13					55	145	538	260	49	90	496			
14					45	135	560	310	44	60	496			
15					45	135	470	360	36	150	456			
16					35	100	372	410	21	150	416			
17					30	85	338	460	21	150	396			
18					30	92	260	510	21	150	376			
19					35	100	390	560	21	150	336			
20					78	100	515	610	21	150	316			
21					115	92	338	653	28	150	296			
22					192	100	650	608	36	190	277			
23					245	100	605	698	83	290	277			
24					230	70	628	608	53	240	277			
25					135	108	628	501	53	240	264			
26					168	108	470	481	44	240	264			
27					192	85	372	481	28	270	277			
28					260	70	290	364	53	320	336			
29					260	70	218	262	53	400	296			
30					192	55	168	262	63	570	296			
31						70		202	53		264			
Total					4,391	4,964	10,948	13,338	1,666	4,725	17,516			Period 1911
Mean					146	160	365	430	54	158	565			269
Maximum					260	560	650	770	187	570	1,740			1,740
Minimum					30	55	55	135	18	36	264			18
Run-off per square mile					0.129	0.142	0.323	0.380	0.048	0.140	0.500			0.238
Run-off, depth, inches					0.144	0.164	0.360	0.438	0.055	0.156	0.576			1.892
Run-off, acre-feet					8,710	9,846	21,715	26,456	3,305	9,372	34,743			114,147
Acre-feet per square mile					7.71	8.71	19.23	23.41	2.92	8.29	30.74			101.01

DISCHARGE OF UNCOMPAHGRE RIVER NEAR DELTA FOR 1912

Drainage Area, 1,130 Square Miles: Altitude, 4,970 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					380	1,390	1,080	300	35				
2					460	1,320	870	245	42				
3					480	1,510	690	168	35				
4					320	1,670	550	118	42				
5					280	1,590	600	105	50				
6					235	1,550	280	95	58				
7					235	1,180	340	58	35				
8					420	1,040	340	42	50				
9					565	1,000	262	35	50				
10					480	1,000	210	42	58				
11					440	900	142	105	65				
12					500	780	105	95	65				
13					480	720	105	50	58				
14					400	450	118	50	75				
15					280	300	105	75	168				
16				140	320	245	105	130	130				
17				140	565	340	65	95	155				
18				128	940	360	50	85	195				
19				80	1,240	228	245	85	180				
20				70	1,330	180	575	65	180				
21				55	1,600	262	525	75	180				
22				35	1,640	360	600	50	210				
23				30	1,380	400	690	42	210				
24				30	1,490	935	575	35	245				
25				40	1,570	840	575	35	245				
26				62	1,830	1,080	720	35	245				
27				35	1,750	1,040	1,040	50	245				
28				55	1,550	1,000	780	50	245				
29				178	1,590	1,110	425	35	210				
30				220	1,670	1,250	400	35	180				
31					1,320		380	65					
Total				1,298	27,740	26,030	13,547	2,550	3,941				Period
Mean				86	895	868	437	82	131				447
Maximum				220	1,830	1,670	1,080	300	245				1,830
Minimum				30	235	180	50	35	35				30
Run-off per square mile				0.076	0.792	0.768	0.387	0.073	0.116				0.396
Run-off, depth, inches				0.042	0.913	0.857	0.446	0.081	0.129				2.470
Run-off, acre-feet				2,575	55,022	51,630	26,870	5,058	7,817				148,973
Acre-feet per square mile				2.26	48.26	45.29	23.57	4.44	6.86				130.68

PLATEAU CREEK NEAR MOLINA

This station was established March 18, 1912, and is located in the NE¼ NE¼ Section 15, Township 10 South, Range 96 West, about fifteen miles southeast of DeBeque.

The equipment consists of a 2″ x 4″ staff gauge, bolted to abutment of highway bridge from which measurements are made during high water.

The bed of the stream is gravel and sand, and apparently permanent.

The observer is W. W. Willard, whose services were furnished free of charge.

DISCHARGE MEASUREMENTS OF PLATEAU CREEK NEAR MOLINA

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 Mar. 18	B. S. Clayton	89	1.31	0.75	117
Apr. 24	B. S. Clayton	81	1.59	0.79	129
May 19	C. C. Hezmalhalch	482	4.01	4.40	1,928
June 21	C. C. Hezmalhalch	180	2.87	1.78	518
Oct. 8	C. E. Turner	52	1.27	0.27	66
Oct. 26	C. E. Turner	62	1.45	0.41	90

DISCHARGE OF PLATEAU CREEK NEAR MOLINA FOR 1912

Drainage Area, 464 Square Miles

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				130	355	1,625	440	150	70	70	105		
2				148	570	1,745	342	138	70	70	105		
3				200	458	1,955	342	95	70	70	105		
4				275	315	1,985	290	78	70	70	105		
5				235	335	1,895	380	70	70	85	105		
6				200	435	1,745	308	40	70	85	105		
7				218	615	1,805	260	40	70	70	115		
8				235	615	1,715	230	40	70	70	105		
9				335	592	1,715	215	30	70	70	105		
10				235	730	1,595	188	30	70	70	105		
11				200	705	1,280	175	30	70	70	105		
12				200	830	1,060	162	30	70	70	105		
13				182	615	955	215	30	55	70	105		
14				115	502	880	360	30	55	70	105		
15				115	592	855	245	30	55	70	105		
16				182	805	730	215	85	55	70	105		
17				148	1,170	638	188	62	70	70	105		
18				130	1,475	592	150	40	70	70	105		
19			130	130	1,775	570	150	40	70	70	105		
20			435	200	1,895	525	200	40	70	70	105		
21			182	165	2,175	525	162	40	70	70	105		
22			100	165	2,175	525	115	40	78	70	105		
23			100	130	1,985	525	105	40	70	70	105		
24			100	115	2,078	570	138	40	70	70	105		
25			115	235	2,078	480	230	40	70	70	105		
26			100	182	2,015	480	150	30	70	115	105		
27			115	218	1,955	592	150	30	70	125	105		
28			100	200	1,895	570	150	40	70	105	105		
29			100	315	1,955	458	150	70	70	115	105		
30			130	375	2,045	502	138	85	70	115	105		
31			85		1,805		138	85		105			
Total			1,792	5,813	37,545	31,092	6,681	1,668	2,048	2,460	3,160		Period
Mean			138	194	1,211	1,036	216	54	68	79	105		359
Maximum			435	375	2,175	1,985	440	150	78	125	115		2,175
Minimum			85	115	315	458	105	30	55	70	105		30
Run-off per square mile			0.297	0.418	2.610	2.233	0.466	0.116	0.147	0.170	0.226		0.774
Run-off, depth, inches			0.144	0.467	3.009	2.491	0.537	0.134	0.164	0.196	0.252		7.394
Run-off, acre-feet			3,554	11,530	74,470	61,671	13,252	3,308	4,062	4,879	6,268		182,994
Acre-feet per square mile			7.66	24.85	160.50	132.90	28.56	7.13	8.75	10.52	13.51		394.38

Platte River Drainage

NORTH FORK SOUTH PLATTE RIVER AT CASSELLS

This station is maintained in co-operation with the United States Geological Survey and is located at Cassells on the South Park branch of the Colorado & Southern railroad.

The equipment consists of a vertical staff gauge fastened to pier of wagon bridge from which measurements are made.

The bed of the stream consists of large and medium sized boulders.

The observer at this station is Lulu Cassell, whose salary is $3.00 per month.

DISCHARGE OF NORTH FORK SOUTH PLATTE RIVER AT CASSELLS FOR 1911

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 8*	R. H. Fletcher	36	0.30	2.08	21
	Jan. 9*	R. H. Fletcher	33	0.70	1.84	23
	Feb. 20*	R. H. Fletcher	23	1.08	1.34	25
	Mar. 13*	R. H. Fletcher	17	1.29	1.16	22
	Mar. 14*	R. H. Fletcher	15	1.60	1.16	24
	Apr. 13	W. B. Freeman	18	1.45	1.20	26
	Apr. 22	O. M. Wimmer	26	1.66	1.34	42
	June 10	J. B. Stewart	76	3.29	2.19	250
	July 12	W. B. Freeman	59	3.02	1.82	178
	Aug. 28	R. H. Fletcher	38	1.77	1.33	67
	Sept. 8	R. H. Fletcher	32	1.87	1.22	60
	Sept. 8	Fletcher & Waha	33	1.60	1.22	53
	Nov. 1	G. H. Russell	19	2.08	1.25	40
1912	Jan. 5*	G. H. Russell	4.5	2.56	1.41	12
	Jan. 30*	G. H. Russell	13	1.18	1.11	15
	Feb. 23*	G. H. Russell	8	1.58	1.09	13
	Mar. 5	Gray & Mathias	15	1.04	0.95	16
	Apr. 6	H. B. Waha	30	1.40	1.19	42
	Apr. 7	H. B. Waha	28	1.33	1.14	37
	Apr. 7	H. B. Waha	16	2.34	1.14	38
	May 16	J. L. Mathias	28	2.15	1.40	60
	June 15	J. L. Mathias	78	4.03	2.35	316
	June 28	Robert Follansbee	83	5.28	2.57	440
	Sept. 13	R. H. Fletcher	33	2.06	1.40	68
	Oct. 21	R. Richards			1.31	65

*Ice conditions.

DISCHARGE OF NORTH FORK SOUTH PLATTE RIVER AT CASSELLS FOR 1911.

Drainage Area, 100 Square Miles. Altitude, 8,530 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	24	26	24	21	59	235	124	90	53	87	30	20	
2	....	24	25	23	18	61	250	278	90	54	65	30	20	
3	....	24	25	23	21	62	298	540	85	53	48	32	20	
4	....	23	26	23	21	68	193	420	85	53	48	27	20	
5	....	24	25	23	16	73	230	665	88	52	93	27	20	
6	....	23	25	23	25	102	240	347	88	53	63	27	20	
7	....	23	25	21	16	100	300	265	105	53	48	27	20	
8	....	20	26	21	17	112	290	240	120	58	52	27	20	
9	....	23	25	23	21	132	285	198	138	53	38	25	20	
10	....	24	25	22	17	132	250	187	138	53	34	25	15	
11	....	22	25	21	26	110	273	195	170	53	30	25	15	
12	....	24	26	21	16	185	233	178	100	53	31	25	15	
13	....	24	26	22	13	190	233	175	82	53	33	25	15	
14	....	24	25	24	7	185	210	175	85	55	30	25	15	
15	....	24	26	22	7	185	215	170	72	63	23	25	15	
16	....	23	26	20	13	217	210	163	73	53	33	25	15	
17	....	24	26	13	10	276	210	178	72	53	27	25	15	
18	....	22	26	9	13	325	198	160	78	52	25	25	15	
19	....	24	26	10	18	185	210	160	77	52	35	25	15	
20	....	24	25	16	42	110	218	137	78	52	30	25	15	
21	....	21	25	9	45	128	250	128	79	52	26	25	15	
22	....	25	25	9	43	122	280	142	82	53	25	25	15	
23	....	25	22	12	55	132	222	127	80	53	35	25	15	
24	....	26	25	10	48	112	190	130	77	52	33	25	15	
25	....	25	21	9	42	107	162	140	73	52	30	20	12	
26	....	25	22	7	52	140	188	140	63	49	33	20	12	
27	....	25	22	18	60	128	178	140	65	49	20.	20	12	
28	....	25	23	9	60	128	142	120	68	48	25	20	12	
29	....	25	....	9	60	155	132	100	62	63	30	20	12	
30	....	25	....	10	42	129	118	100	58	73	33	20	12	
31	....	26	....	13	....	170	....	90	55	....	35	....	12	
Total	....	740	695	519	865	4,320	6,643	6,312	2,676	1,613	1,198	772	489	Year 1911
Mean	....	24	25	17	29	139	221	204	86	54	39	26	16	74
Maximum	....	26	26	24	60	325	300	665	170	73	93	32	20	665
Minimum	....	20	21	7	7	59	118	90	55	52	20	20	12	7
Run-off per square mile	....	0.239	0.248	0.167	0.288	1.390	2.210	2.040	0.863	0.538	0.386	0.257	0.158	0.735
Run-off, depth, inches	....	0.276	0.258	0.192	0.322	1.603	2.466	2.352	0.995	0.560	0.445	0.287	0.182	9.977
Run-off, acre-feet	....	1,468	1,378	1,029	1,716	8,569	13,176	12,520	5,308	3,199	2,376	1,531	970	53,240
Acre-feet per square mile	....	14.68	13.78	10.29	17.16	85.69	131.76	125.20	53.08	31.99	23.76	15.31	9.70	532.40

NOTE.—Ice conditions Jan. 1-Mar. 14, Nov. 4-Dec. 31. Discharge estimated from measurements.

DISCHARGE OF NORTH FORK SOUTH PLATTE RIVER AT CASSELLS FOR 1912

Drainage Area, 100 Square Miles. Altitude, 8,530 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	12	15	15	25	74	315	502	124	83	68	....	....	
2	12	15	15	31	74	255	408	149	83	68	....	....	
3	12	15	15	38	74	275	364	136	76	62	....	....	
4	12	15	16	41	50	498	364	113	68	55	....	....	
5	12	15	16	46	61	574	323	113	62	68	....	....	
6	12	14	18	46	68	548	323	136	68	83	....	....	
7	12	14	18	50	68	600	302	113	68	76	....	....	
8	12	14	20	50	74	704	323	124	62	68	....	....	
9	12	14	20	41	74	358	408	113	55	62	....	....	
10	14	14	22	34	50	358	364	124	68	68	....	....	
11	14	14	22	41	50	335	364	102	68	68	....	....	
12	14	14	25	41	41	295	344	68	83	68	....	....	
13	14	14	25	28	41	295	323	92	68	83	....	....	
14	14	14	24	28	50	315	323	102	68	76	....	....	
15	14	13	25	31	56	295	364	124	68	68	....	....	
16	14	13	25	28	61	340	323	124	76	68	....	....	
17	14	13	25	28	90	342	282	102	68	55	....	....	
18	14	13	24	26	108	300	263	124	68	55	....	....	
19	14	13	28	28	120	282	244	113	68	55	....	....	
20	14	13	25	28	131	285	226	102	76	....	....	....	
21	15	13	28	26	238	287	209	124	68	....	....	....	
22	15	13	31	28	204	308	209	102	68	....	....	....	
23	15	13	31	31	204	490	244	102	62	....	....	....	
24	15	13	22	34	187	445	282	83	68	....	....	....	
25	15	14	24	31	358	447	244	83	62	....	....	....	
26	15	14	26	31	358	495	263	83	62	....	....	....	
27	15	14	26	28	295	550	244	68	68	....	....	....	
28	15	15	28	34	335	550	193	83	68	....	....	....	
29	15	15	22	38	380	599	163	76	55	....	....	....	
30	15	....	28	68	548	599	136	83	55	....	....	....	
31	15	....	26	....	474	....	163	83	....	....	....	....	
Total	427	403	715	1,058	4,996	12,339	9,167	3,268	2,040	1,274	....	....	Period
Mean	14	14	23	35	161	411	296	105	68	67	....	....	121
Maximum	15	15	31	68	548	704	502	149	83	83	....	....	704
Minimum	12	13	15	25	41	255	136	68	55	55	....	....	12
Run-off per square mile	0.138	0.139	0.231	0.353	1.612	4.113	2.957	1.054	0.680	0.671	....	....	1.214
Run-off, depth, inches	0.159	0.150	0.266	0.394	1.858	4.589	3.409	1.215	0.759	0.474	....	....	13.273
Run-off, acre-feet	847	799	1,418	2,098	9,910	24,474	18,183	6,483	4,046	2,527	....	....	70,785
Acre-feet per square mile	8.47	7.99	14.18	20.98	99.10	244.74	181.83	64.83	40.46	25.27	....	....	707.85

NOTE.—Ice conditions Jan. 1-Mar. 11. Discharge estimated from measurements.

SOUTH FORK SOUTH PLATTE RIVER AT LAKE GEORGE

This station is located about one-fourth mile below Lake George near Hayman post office. It is maintained in co-operation with the United States Forest Service.

The equipment consists of a Bristol automatic gauge and staff gauge fastened to pier of highway bridge.

The bed of the stream is composed of gravel and boulders and is slightly shifting.

The observer at this station is the forest ranger whose services are gratis.

DISCHARGE MEASUREMENTS OF SOUTH FORK SOUTH PLATTE RIVER AT LAKE GEORGE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 11*	Russell & Wimmer	7.6	0.21	0.74	1.6
Apr. 26	O. M. Wimmer	15	0.87	1.20	13
July 8	E. O. Christiansen	197	3.70	3.32	729
Sept. 25	H. B. Waha	29	0.85	1.78	42
1912 Mar. 13*	H. B. Waha	0.8	0.50	0.90	0.4
June 20	H. B. Waha	91	3.39	2.60	308

* Ice conditions.

DISCHARGE OF SOUTH FORK SOUTH PLATTE RIVER AT LAKE GEORGE FOR 1911

Drainage Area, 980 Square Miles. Altitude, 7,963 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	2	4	4	98	6	8	152	185	98	47	33	17	
2	....	2	4	7	98	8	8	242	185	98	47	33	15	
3	....	2	4	7	78	8	8	865	152	98	29	37	8	
4	....	2	4	5	98	8	7	790	152	88	17	42	8	
5	....	2	4	10	70	12	6	865	137	78	26	42	12	
6	....	2	4	7	47	12	7	718	122	78	61	42	12	
7	....	2	4	10	33	8	29	683	110	70	98	37	12	
8	....	2	6	13	20	13	54	754	98	70	88	37	10	
9	....	2	6	20	20	13	88	583	98	70	42	42	12	
10	....	2	6	47	15	10	78	403	98	61	37	37	8	
11	....	2	6	54	22	8	70	122	110	61	47	20	6	
12	....	2	6	15	22	8	61	152	137	61	26	26	6	
13	....	2	6	20	12	8	70	122	122	54	12	26	7	
14	....	2	6	33	8	7	137	204	110	54	37	22	7	
15	....	2	6	37	10	12	185	185	110	70	37	29	7	
16	....	2	6	42	8	17	222	222	98	78	33	29	5	
17	....	2	8	37	13	22	242	137	110	78	33	22	5	
18	....	3	7	42	13	26	242	110	122	61	29	22	5	
19	....	3	8	29	13	26	353	137	110	47	29	17	5	
20	....	3	6	37	10	20	378	152	98	47	26	17	7	
21	....	3	3	47	13	26	378	242	110	54	22	22	5	
22	....	3	3	37	13	29	378	263	122	61	22	29	5	
23	....	3	3	42	10	29	430	286	168	61	37	37	5	
24	....	3	7	61	13	22	353	308	204	98	78	33	5	
25	....	3	7	88	15	22	222	330	185	137	78	33	5	
26	....	3	4	37	17	22	185	353	110	47	42	37	3	
27	....	3	2	37	15	20	152	308	110	47	42	26	3	
28	....	3	3	42	13	13	168	242	110	47	42	20	3	
29	....	3	....	88	12	13	168	185	110	47	22	22	3	
30	....	3	....	47	8	8	152	204	98	47	15	17	3	
31	....	3	....	26	....	10	....	185	98	....	29	....	3	
Total	....	76	143	1,028	837	466	4,839	10,486	3,889	2,066	1,230	888	217	Year 1911
Mean	....	2	5	33	28	15	161	338	125	69	40	30	7	72
Maximum	....	3	8	88	98	29	430	865	204	137	98	42	17	865
Minimum	....	2	2	4	8	6	6	110	98	47	12	17	3	2
Run-off per square mile	....	0.002	0.005	0.034	0.028	0.015	0.164	0.345	0.127	0.070	0.041	0.031	0.007	0.073
Run-off, depth, inches	....	0.002	0.005	0.039	0.031	0.018	0.183	0.398	0.146	0.078	0.047	0.034	0.008	0.991
Run-off, acre-feet	....	151	284	2,039	1,660	924	9,598	20,794	7,714	4,098	2,439	1,762	429	51,897
Acre-feet per square mile	....	0.15	0.29	2.08	1.69	0.94	9.79	21.22	7.87	4.18	2.49	1.80	0.44	52.96

NOTE.—Discharge estimated Jan. 1-Feb. 17, Dec. 12-31.

DISCHARGE OF SOUTH FORK SOUTH PLATTE RIVER AT LAKE GEORGE FOR 1912

Drainage Area, 980 Square Miles. Altitude, 7,963 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	5	5	4	26	29	137	488	488	42	....	....	....	
2	5	7	4	29	33	110	330	430	37	....	....	....	
3	5	6	3	37	20	88	152	330	37	....	....	....	
4	7	4	2	42	15	98	222	285	29	....	....	....	
5	10	4	3	42	12	204	1,685	185	29	....	....	....	
6	10	5	4	78	10	222	1,270	152	33	....	....	....	
7	15	6	4	78	10	308	222	152	37	....	....	....	
8	10	6	3	122	17	403	403	152	42	....	....	....	
9	8	6	3	152	29	403	518	168	42	....	....	....	
10	10	7	6	110	33	353	648	137	37	....	....	....	
11	7	6	3	54	33	242	648	122	37	....	....	....	
12	6	5	3	42	37	263	648	98	47	....	....	....	
13	6	5	5	42	33	242	648	88	61	....	....	....	
14	4	5	3	26	42	222	648	98	33	....	....	....	
15	5	5	4	22	42	185	648	152	29	....	....	....	
16	8	7	7	26	47	152	458	185	61	....	....	....	
17	8	7	5	26	54	152	353	152	61	....	....	....	
18	10	7	6	33	61	263	308	137	61	....	....	....	
19	8	5	13	37	54	286	330	110	61	....	....	....	
20	7	3	26	42	42	242	330	78	61	....	....	....	
21	6	4	29	26	42	168	286	88	61	....	....	....	
22	7	6	42	42	33	137	222	88	61	....	....	....	
23	6	7	33	33	29	152	242	78	61	....	....	....	
24	7	4	33	37	29	185	330	78	61	....	....	....	
25	10	3	37	26	42	263	378	61	61	....	....	....	
26	10	3	42	22	47	330	430	61	61	....	....	....	
27	13	3	42	29	47	378	488	47	54	....	....	....	
28	8	3	37	22	68	430	430	47	54	....	....	....	
29	6	4	54	29	68	583	648	42	54	....	....	....	
30	6	....	33	29	47	616	583	42	54	....	....	....	
31	5	....	33	....	42	....	583	47	....	....	....	....	
Total	238	148	526	1,361	1,147	7,817	15,577	4,378	1,459	....	....	....	Period
Mean	8	5	17	45	37	261	502	141	49	....	....	....	119
Maximum	15	7	54	152	68	616	1,685	488	61	....	....	....	1,685
Minimum	4	3	2	22	10	88	152	42	29	....	....	....	2
Run-off per square mile	0.008	0.005	0.017	0.046	0.038	0.266	0.512	0.144	0.050	....	....	....	0.121
Run-off, depth, inches	0.009	0.005	0.020	0.051	0.044	0.297	0.590	0.166	0.056	....	....	....	1.233
Run-off, acre-feet	472	294	1,043	2,699	2,275	15,505	30,897	8,684	2,894	....	....	....	64,763
Acre-feet per square mile	0.48	0.30	1.06	2.75	2.32	15.82	31.53	8.86	2.95	....	....	....	66.08

SOUTH FORK SOUTH PLATTE RIVER AT SOUTH PLATTE

This station is maintained in co-operation with the United States Geological Survey and is located about one-fourth mile above South Platte station on the Colorado & Southern railroad.

The equipment, which is the property of the United States Geological Survey, consists of a cable of 100 feet span, with car and 4" x 4" slope gauge rod.

The bed of the stream consists of boulders and gravel and is fairly permanent.

The observer at this station is Miss A. Vermillion, who is paid $3.50 per month.

DISCHARGE MEASUREMENTS OF SOUTH FORK SOUTH PLATTE RIVER AT SOUTH PLATTE

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 10*	R. H. Fletcher	62	1.22	1.98	76
	Feb. 22*	R. H. Fletcher	39	1.97	1.90	77
	Mar. 16	R. H. Fletcher	28	1.67	1.50	47
	May 10	Miles & Turner	37	1.96	1.87	72
	May 23	R. C. Miles	92	3.70	2.80	344
	June 12	J. B. Stewart	29	3.24	2.00	94
	July 11	G. H. Russell	184	5.13	3.95	944
	Aug. 18	R. H. Fletcher	72	2.78	2.35	200
	Aug. 29	R. H. Fletcher	74	3.22	2.55	237
	Sept. 8	Fletcher & Waha	69	2.83	2.40	196
	Nov. 4	G. H. Russell	37	1.96	1.92	72
	Dec. 16	R. H. Fletcher	39	1.87	1.80	73
1912	Jan. 4*	G. H. Russell	47	2.31	3.60	108
	Jan. 29*	G. H. Russell	20	1.78	1.70	35
	Feb. 27*	G. H. Russell	21	2.12	2.22	44
	Apr. 29	G. A. Gray	25	1.94	1.60	49
	June 1	G. A. Gray	48	2.49	2.40	120
	July 2	Follansbee & Gray	219	5.30	4.83	1,160
	Aug. 7	Robert Follansbee	138	4.67	3.50	644
	Sept. 14	R. H. Fletcher	89	3.09	2.70	275
	Oct. 23	R. Richards	....	....	1.98	102
	Nov. 15	R. H. Fletcher	48	2.19	1.90	106

*Ice conditions.

DISCHARGE OF SOUTH FORK SOUTH PLATTE RIVER AT SOUTH PLATTE FOR 1910

Drainage Area, 2,160 Square Miles. Altitude, 6,097 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	110	122	94	242	425	317	200	170	125	114	95	54	
2	110	113	114	242	430	318	274	455	125	114	88	54	
3	110	104	136	258	434	319	342	580	114	114	80	54	
4	115	88	136	242	476	320	308	530	114	114	86	54	
5	115	88	214	242	503	318	308	435	114	96	110	46	
6	120	88	274	242	420	315	308	410	96	96	109	50	
7	120	75	242	94	405	408	308	382	88	96	108	54	
8	125	53	274	94	370	362	308	340	88	96	106	54	
9	130	53	291	94	335	335	173	315	105	105	117	59	
10	135	53	644	242	337	317	78	564	88	105	127	54	
11	142	58	620	258	339	330	78	564	96	105	125	54	
12	142	49	550	258	380	295	78	564	96	105	115	54	
13	142	53	506	274	380	305	78	610	96	105	103	50	
14	132	58	462	325	340	270	78	541	96	105	112	50	
15	142	78	462	308	425	300	78	196	96	105	110	50	
16	142	78	420	242	403	315	78	114	96	105	110	50	
17	162	86	441	258	445	312	94	246	114	114	100	50	
18	162	86	462	258	540	343	104	246	105	114	98	45	
19	184	94	462	258	490	340	94	246	96	114	90	45	
20	173	114	462	274	408	274	114	182	96	114	82	45	
21	184	148	462	308	410	214	114	240	125	114	80	45	
22	184	136	462	325	430	242	125	256	136	147	70	45	
23	173	136	342	325	476	242	114	256	170	147	70	45	
24	142	114	342	325	520	242	114	256	147	147	64	45	
25	132	94	342	342	522	136	292	136	147	147	59	45	
26	113	94	308	342	480	136	308	125	147	147	70	55	
27	122	94	308	342	395	114	322	136	147	136	70	55	
28	122	94	274	338	435	125	362	125	147	136	54	55	
29	113	....	274	378	375	136	550	125	147	136	64	55	
30	122	....	242	380	314	136	350	114	147	136	64	55	
31	122	....	242	....	316	....	322	136	....	136	....	55	
Total	4,242	2,501	10,864	8,110	12,958	8,136	6,454	9,595	3,504	3,665	2,736	1,551	Year
Mean	137	89	350	270	418	271	208	310	117	118	91	50	204
Maximum	184	148	644	380	540	408	550	610	170	147	127	59	644
Minimum	110	49	94	94	314	114	78	114	88	96	54	45	45
Run-off per square mile	0.063	0.041	0.162	0.125	0.194	0.125	0.096	0.144	0.054	0.055	0.042	0.023	0.094
Run-off, depth, inches	0.073	0.043	0.186	0.140	0.224	0.140	0.111	0.166	0.060	0.064	0.047	0.027	1.276
Run-off, acre-feet	8,414	4,961	21,548	16,086	25,702	16,138	12,801	19,031	6,950	7,269	5,427	3,076	147,403
Acre-feet per per square mile	3.90	2.30	9.98	7.45	11.90	7.47	5.93	8.81	3.22	3.36	2.51	1.42	68.24

NOTE.—Discharge estimated Jan. 1-11, Dec. 1-31.

DISCHARGE OF SOUTH FORK SOUTH PLATTE RIVER AT SOUTH PLATTE FOR 1911

Drainage Area, 2,160 Square Miles. Altitude, 6,097 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	65	55	72	46	142	105	432	242	254	106	58	85	
2	....	65	50	53	94	116	105	432	165	290	106	70	85	
3	....	65	50	61	233	105	156	480	165	290	106	70	85	
4	....	65	55	66	302	94	156	432	165	254	188	70	85	
5	....	70	65	61	323	86	116	432	448	254	188	70	85	
6	....	70	55	61	323	78	94	323	500	220	188	64	85	
7	....	70	65	56	284	78	86	555	472	220	106	64	85	
8	....	70	55	61	233	78	86	1,040	170	188	86	64	85	
9	....	75	60	56	170	78	86	1,040	170	188	86	70	75	
10	....	75	55	61	129	72	86	1,040	442	188	58	70	75	
11	....	75	55	56	116	72	86	1,010	283	158	58	70	75	
12	....	75	60	53	116	78	86	975	215	158	53	86	75	
13	....	70	60	46	105	66	86	975	215	144	48	58	75	
14	....	70	60	44	105	72	86	975	215	130	48	58	75	
15	....	70	60	46	94	72	116	975	200	106	48	58	75	
16	....	75	65	48	94	78	170	975	182	106	48	58	75	
17	....	70	65	46	94	72	170	975	182	118	48	58	75	
18	....	55	65	44	86	78	170	200	200	106	48	58	75	
19	....	55	55	46	86	78	170	130	198	106	48	58	80	
20	....	60	60	46	78	116	170	585	198	106	48	58	80	
21	....	65	70	48	66	302	302	585	175	106	48	58	80	
22	....	65	77	50	86	323	302	585	175	106	48	58	80	
23	....	65	77	46	94	323	233	750	540	103	48	53	80	
24	....	65	85	48	72	323	233	750	540	106	48	53	90	
25	....	75	90	46	78	323	302	755	540	106	48	53	90	
26	....	85	94	46	72	323	302	700	540	106	48	58	90	
27	....	75	72	42	56	323	344	545	260	106	48	58	90	
28	....	75	78	48	61	216	344	445	260	106	48	42	100	
29	....	70	....	46	78	129	386	445	260	106	48	58	100	
30	....	70	....	46	200	116	432	355	254	106	48	86	100	
31	....	55	....	44	....	116	....	335	251	....	58	....	100	
Total	....	2,190	1,813	1,593	3,974	4,526	5,566	20,231	8,825	4,644	2,251	1,867	2,590	Year
Mean	....	71	65	51	132	146	186	653	285	155	73	62	84	165
Maximum	....	85	94	72	323	323	432	1,040	540	290	188	86	100	1,040
Minimum	....	55	50	42	46	66	86	130	165	106	48	42	75	42
Run-off per square mile	....	0.033	0.030	0.024	0.061	0.068	0.086	0.302	0.132	0.072	0.034	0.029	0.039	0.076
Run-off, depth, inches	....	0.038	0.031	0.028	0.068	0.079	0.096	0.348	0.152	0.080	0.039	0.032	0.045	1.032
Run-off, acre-feet	....	4,344	3,596	3,160	7,882	8,977	11,040	40,128	17,504	9,211	4,465	3,703	5,137	119,147
Acre-feet per square mile	....	2.01	1.66	1.46	3.65	4.16	5.11	18.58	8.10	4.26	2.07	1.71	2.38	55.16

NOTE.—Discharge estimated Jan. 1-Feb. 26. Nov. 26-Dec. 31.

DISCHARGE OF SOUTH FORK SOUTH PLATTE RIVER AT SOUTH PLATTE FOR 1912

Drainage Area, 2,160 Square Miles. Altitude, 6,097 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	105	35	45	40	59	137	1,265	1,470	147	220	140	....	
2	105	35	45	40	56	137	1,465	1,340	147	225	140	....	
3	105	35	45	45	56	155	1,280	1,280	258	225	140	....	
4	110	35	45	95	52	320	795	1,090	465	195	140	....	
5	110	35	45	75	52	355	540	855	440	165	140	....	
6	100	35	45	75	52	435	550	645	395	140	250	....	
7	100	38	45	59	59	475	425	645	395	140	440	....	
8	100	38	40	59	45	725	565	590	350	140	495	....	
9	90	38	40	59	59	950	290	590	395	140	495	....	
10	90	38	40	59	75	1,010	265	540	395	200	405	....	
11	90	38	40	75	75	201	215	490	395	200	285	....	
12	90	38	40	59	75	201	190	440	395	145	245	....	
13	80	38	40	52	75	201	190	395	395	120	185	....	
14	75	40	40	45	75	177	255	395	310	120	130	....	
15	70	40	40	45	85	177	395	540	240	120	105	....	
16	60	40	40	45	121	177	735	540	240	240	105	....	
17	60	40	40	40	137	435	740	395	245	210	105	....	
18	55	40	45	40	137	780	750	490	145	150	105	....	
19	50	40	40	45	155	1,135	645	440	320	150	105	....	
20	45	40	40	45	177	1,135	655	395	320	150	105	....	
21	40	45	32	40	155	950	825	395	320	150	105	....	
22	35	45	40	40	137	670	570	395	325	130	105	....	
23	35	45	40	45	137	670	780	350	250	130	105	....	
24	35	45	40	45	137	620	680	310	215	130	105	....	
25	35	45	40	45	137	780	910	275	215	130	105	....	
26	35	45	40	45	137	835	920	275	220	135	75	....	
27	35	45	40	52	121	890	1,230	440	220	135	75	....	
28	35	45	40	52	121	1,135	1,125	395	220	135	75	....	
29	35	45	40	56	121	1,070	1,250	395	185	140	105	....	
30	35	....	40	56	137	1,265	1,250	275	110	140	105	....	
31	35	....	40	....	137	....	1,325	147	....	140	....	....	
Total	2,080	1,161	1,272	1,573	3,154	18,203	23,075	17,217	8,672	4,890	5,220	....	Period
Mean	67	40	41	52	102	607	744	555	289	158	174	....	258
Maximum	110	45	45	95	177	1,265	1,465	1,470	465	240	495	....	1,470
Minimum	35	35	32	40	45	137	190	147	110	120	75	....	32
Run-off per square mile	0.031	0.019	0.019	0.024	0.047	0.281	0.344	0.257	0.134	0.073	0.081	....	0.119
Run-off, depth, inches	0.036	0.020	0.022	0.027	0.054	0.314	0.397	0.296	0.150	0.084	0.090	....	1.490
Run-off, acre-feet	4,125	2,303	2,523	3,120	6,256	36,106	45,769	34,150	17,200	9,700	10,354	....	171,606
Acre-feet per square mile	1.91	1.07	1.17	1.44	2.90	16.71	21.19	15.81	7.96	4.49	4.79	....	79.44

NOTE.—Ice conditions Jan. 1-Mar. 18. Discharge estimated from measurements.

SOUTH PLATTE RIVER AT SOUTH PLATTE

This station is located about 100 yards below the junction of the North and South Forks of the South Platte river and 200 yards below South Platte station on the Colorado and Southern railroad. The station is maintained in co-operation with the United States Geological Survey.

The equipment consists of a cable of 120 feet span with car and 4″ x 4″ slope gauge.

The bed of the stream is sand and gravel and is shifting in character.

The observer is Miss A. Vermillion, who is paid $3.50 per month.

Owing to error in computations the discharges for 1910, as published in the Fifteenth Biennial Report, were incorrect. The correct table for that year is, therefore, included in this report.

DISCHARGE MEASUREMENTS OF SOUTH PLATTE RIVER AT SOUTH PLATTE

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 10	R. H. Fletcher	58	1.91	2.08	111
	Feb. 22	R. H. Fletcher	57	1.86	1.88	106
	Mar. 15	R. H. Fletcher	36	2.00	1.48	72
	Mar. 16	R. H. Fletcher	53	1.84	1.60	98
	May 10	Turner & Miles	107	3.37	2.58	361
	June 12	J. B. Stewart	142	3.13	2.75	445
	July 11	G. H. Russell	314	3.80	4.28	1,194
	Aug. 18	R. H. Fletcher	127	2.41	2.37	308
	Aug. 29	R. H. Fletcher	121	2.67	2.00	324
	Sept. 8	Fletcher & Waha	117	2.43	2.04	284
	Nov. 3	G. H. Russell	51	1.85	1.65	94
	Dec. 16	R. H. Fletcher	58	2.00	1.80	116
1912	Jan. 4*	G. H. Russell	66	1.94	3.02	129
	Jan. 29*	G. H. Russell	36	1.79	1.60	64
	Feb. 27*	G. H. Russell	73	1.09	2.50	80
	Apr. 29	G. A. Gray	67	2.01	1.75	134
	June 1	G. A. Gray	216	3.75	3.45	811
	July 2	Follansbee & Gray	373	5.42	5.40	2,020
	Aug. 7	Robert Follansbee	227	4.16	3.81	944
	Sept. 14	R. H. Fletcher	148	2.71	2.70	402
	Oct. 23†	R. Richards			2.12	240
	Nov. 15	R. H. Fletcher	78	2.26	2.10	177

*Ice conditions. † Discharge sum of North and South Forks.

DISCHARGE OF SOUTH PLATTE RIVER AT SOUTH PLATTE FOR 1910

Drainage Area, 2,610 Square Miles. Altitude, 6,097 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	200	182	160	354	605	600	388	400	182	162	136	68	
2	200	206	182	370	600	600	388	610	194	162	126	68	
3	200	182	234	370	600	598	420	660	182	160	126	83	
4	200	160	234	322	635	598	404	610	194	160	126	83	
5	200	160	322	322	630	540	404	545	182	150	146	68	
6	225	160	354	306	570	540	388	560	160	155	136	68	
7	225	120	338	322	550	576	373	510	150	155	136	68	
8	225	120	370	322	530	558	343	430	150	160	156	83	
9	225	120	386	322	530	540	313	365	171	155	156	83	
10	225	111	710	322	548	522	197	630	171	153	156	90	
11	215	120	710	338	548	505	186	630	150	158	167	83	
12	215	120	650	354	560	522	175	670	150	152	167	83	
13	215	130	610	386	600	488	175	650	160	130	156	98	
14	215	140	610	440	630	522	175	590	160	140	146	76	
15	215	160	610	422	625	488	186	276	160	160	156	70	
16	210	182	610	370	615	505	186	248	160	180	156	70	
17	210	160	590	386	590	522	186	290	160	195	136	70	
18	210	171	610	386	665	505	186	322	160	178	146	70	
19	210	182	590	404	650	488	153	306	160	176	146	70	
20	210	206	610	422	572	420	164	306	160	190	126	70	
21	205	234	590	476	555	358	175	370	171	190	126	75	
22	205	248	570	458	590	373	175	386	194	200	116	75	
23	205	234	590	476	660	358	175	386	194	200	107	75	
24	205	234	570	494	680	343	220	386	194	186	126	75	
25	208	182	513	513	660	343	375	248	180	186	126	80	
26	212	206	494	513	605	298	365	194	180	175	107	80	
27	170	206	440	532	605	284	380	194	180	160	98	80	
28	190	182	404	552	620	270	410	194	178	160	76	80	
29	218	....	404	590	620	270	670	206	178	170	83	85	
30	195	....	354	605	602	373	640	182	178	160	76	85	
31	205	....	338	....	602	....	690	182	....	145	....	85	
Total	6,468	4,818	13,557	12,449	18,652	13,907	9,665	12,536	5,143	5,163	3,933	2,397	Year
Mean	209	172	437	415	602	464	312	404	171	167	131	77	298
Maximum	225	248	710	605	680	600	690	670	194	200	167	98	710
Minimum	170	111	160	306	530	270	153	182	150	130	76	68	68
Run-off per square mile	0.080	0.066	0.167	0.159	0.231	0.178	0.120	0.155	0.066	0.064	0.050	0.030	0.114
Run-off, depth, inches	0.092	0.069	0.192	0.178	0.266	0.199	0.138	0.178	0.074	0.074	0.056	0.035	1.547
Run-off, acre-feet	12,829	9,556	26,890	24,692	36,996	27,584	19,170	24,865	10,201	10,241	7,801	4,754	215,579
Acre-feet per square mile	4.92	3.66	10.30	9.46	14.17	10.57	7.34	9.53	3.91	3.92	2.99	1.82	82.59

NOTE.—Discharge estimated Jan. 1-23, Dec. 15-31.

DISCHARGE OF SOUTH PLATTE RIVER AT SOUTH PLATTE FOR 1911

Drainage Area, 2,610 Square Miles. Altitude, 6,097 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	100	95	105	95	226	438	617	303	340	237	100	100	
2	....	100	85	95	160	212	480	732	286	390	220	90	100	
3	....	100	85	86	240	185	480	908	303	360	190	95	105	
4	....	105	85	95	283	185	480	732	337	335	245	115	105	
5	....	105	95	95	298	212	500	807	529	330	260	115	105	
6	....	110	85	95	298	240	460	986	508	310	320	95	105	
7	....	115	95	86	254	268	460	1,013	446	290	225	95	115	
8	....	105	85	95	212	298	440	1,202	303	270	195	105	115	
9	....	105	85	95	198	314	485	1,175	466	270	170	105	115	
10	....	110	85	95	160	347	445	1,148	487	250	140	115	115	
11	....	110	95	105	148	238	428	1,148	508	235	130	115	115	
12	....	110	95	77	148	195	428	1,121	337	210	115	85	115	
13	....	110	95	70	137	283	426	1,148	303	205	115	77	115	
14	....	115	86	70	137	283	408	1,148	286	205	110	115	115	
15	....	105	86	70	115	355	426	1,121	286	290	110	95	115	
16	....	105	95	86	126	370	487	1,121	286	200	108	95	115	
17	....	105	95	86	137	370	508	1,148	286	200	108	85	110	
18	....	85	95	77	126	392	466	640	303	210	105	85	110	
19	....	95	100	86	137	430	466	487	280	210	103	95	110	
20	....	95	100	70	137	412	466	782	280	210	95	85	110	
21	....	105	105	77	137	490	550	782	290	210	92	85	110	
22	....	115	105	86	160	535	508	807	390	205	92	95	110	
23	....	85	105	77	172	535	550	832	525	205	100	70	110	
24	....	105	110	77	212	535	550	807	515	190	110	70	105	
25	....	115	110	86	240	535	550	807	535	190	110	85	105	
26	....	95	115	77	240	560	550	832	510	200	110	85	105	
27	....	95	95	63	226	515	550	709	335	200	108	90	105	
28	....	95	105	77	212	455	572	617	345	200	105	95	105	
29	....	95	....	70	240	435	572	594	325	195	115	95	105	
30	....	95	....	77	268	400	617	487	325	220	105	100	105	
31	....	95	....	86	....	380	....	337	332	.....	105	....	105	
Total		3,205	2,672	2,592	5,653	11,190	14,746	26,795	11,550	7,245	4,453	2,832	3,380	Year 1911
Mean		103	95	84	188	361	492	864	373	242	144	94	109	264
Maximum		115	115	105	298	560	617	1,202	535	390	320	115	115	1,202
Minimum		85	85	63	95	185	408	337	280	190	92	70	100	63
Run-off per square mile		0.039	0.036	0.032	0.072	0.138	0.188	0.331	0.143	0.093	0.055	0.036	0.042	0.101
Run-off, depth, inches		0.045	0.038	0.037	0.080	0.159	0.210	0.381	0.165	0.104	0.064	0.040	0.048	1.371
Run-off, acre-feet		6,357	5,300	5,141	11,213	22,195	29,218	53,147	22,909	14,370	8,832	5,617	6,704	191,034
Acre-feet per square mile		2.44	2.03	1.97	4.30	8.50	11.21	20.36	8.78	5.51	3.38	2.15	2.57	73.19

NOTE.—Ice conditions Jan. 1-Feb. 25, Nov. 26-Dec. 31. Discharge estimated from measurements.

DISCHARGE OF SOUTH PLATTE RIVER AT SOUTH PLATTE FOR 1912

Drainage Area, 2,610 Square Miles. Altitude, 6,097 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	115	65	80	68	200	815	2,025	1,890	270	275	210	....	
2	130	65	80	60	215	790	1,950	1,750	240	310	210	....	
3	130	65	80	75	245	995	1,650	1,500	335	310	210	....	
4	130	65	80	108	215	1,160	1,420	1,230	560	295	205	....	
5	130	65	80	132	190	1,160	1,240	1,140	535	280	205	....	
6	130	65	80	145	165	1,132	1,210	1,000	490	235	320	....	
7	110	65	80	120	190	1,132	1,100	945	490	250	510	....	
8	110	70	75	120	205	1,395	1,015	865	455	265	565	....	
9	110	70	75	120	220	1,492	935	785	455	280	565	....	
10	100	70	75	132	280	1,590	855	735	470	350	475	....	
11	100	70	75	120	265	1,525	780	665	450	330	355	....	
12	100	70	75	120	265	815	780	595	485	285	310	....	
13	100	70	75	108	240	890	780	550	485	255	250	....	
14	100	75	75	85	225	765	830	565	405	255	195	....	
15	100	75	75	85	300	765	1,095	660	365	210	176	....	
16	100	75	75	95	370	740	1,205	705	350	255	176	....	
17	90	75	75	85	445	940	1,205	685	350	255	163	....	
18	90	75	75	85	565	1,275	1,175	635	255	240	138	....	
19	90	75	75	95	635	1,765	1,090	545	375	240	127	....	
20	90	75	75	108	615	1,765	1,120	525	390	240	127	....	
21	75	75	75	75	640	1,558	1,175	525	430	210	127	....	
22	75	80	75	75	710	1,558	1,060	505	410	200	127	....	
23	75	80	68	85	740	1,395	1,170	485	355	230	127	....	
24	75	80	60	85	740	1,460	1,115	445	320	200	127	....	
25	75	80	68	95	765	1,625	1,340	445	320	200	127	....	
26	65	80	75	108	840	1,525	1,530	430	305	210	96	....	
27	65	80	68	120	795	1,660	1,560	485	340	220	96	....	
28	65	80	68	120	700	1,695	1,430	465	325	220	96	....	
29	65	80	75	132	725	1,800	1,460	465	305	215	127	....	
30	65	....	85	145	875	2,025	1,760	370	245	215	127	....	
31	65	....	68	....	985	....	1,795	350	....	210	....	....	
Total	2,930	2,115	2,320	3,106	14,565	39,207	38,855	22,940	11,565	7,715	6,669	....	Year
Mean	95	73	75	104	470	1,307	1,253	740	386	249	222	....	454
Maximum	130	80	85	145	985	2,025	2,025	1,890	560	350	565	....	2,025
Minimum	65	65	60	60	165	740	780	350	240	200	96	....	60
Run-off per square mile	0.036	0.028	0.029	0.040	0.180	0.501	0.480	0.284	0.148	0.095	0.085	....	0.174
Run-off, depth, inches	0.042	0.030	0.033	0.045	0.208	0.559	0.553	0.327	0.165	0.110	0.095	....	2.167
Run-off, acre-feet	5,811	4,195	4,601	6,161	28,889	77,768	77,068	45,502	22,939	15,302	13,228	....	301,464
Acre-feet per square mile	2.23	1.61	1.76	2.36	11.07	29.80	29.53	17.43	8.79	5.86	5.07	....	115.51

NOTE.—Ice conditions Jan. 1-Mar. 20. Discharge estimated from measurements.

SOUTH PLATTE RIVER AT DENVER

This station, maintained by the State, is located at the 16th St. viaduct and about 500 feet below the mouth of Cherry creek.

The equipment consists of an automatic gauge with auxiliary chain gauge.

The bed of the stream is composed of sand and gravel and is shifting in character.

Since the flood of July 14th down Cherry creek, when the dam of the Farmers' & Gardeners' ditch was washed out, the bed of the river has scoured out at the gauging station between three and four feet and results have not been good.

The gauge at this station is taken care of by employees of the State Engineer's office.

DISCHARGE MEASUREMENTS OF SOUTH PLATTE RIVER AT DENVER

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 17	Clayton & Turner	75	2.38	1.18	179
Feb. 24	Thos. Grieve, Jr.	61	1.80	1.08	110
Mar. 11	F. Cogswell	62	1.78	1.10	110
Apr. 4	Clayton & Turner	78	2.28	1.33	177
May 1	Thos. Grieve, Jr.	106	2.40	1.52	254
June 19	C. C. Hezmalhalch	145	2.27	1.69	331
June 24	F. Cogswell	162	2.45	1.72	396
July 5	Bunger & Hezmalhalch	215	2.15	1.78	463
July 11	Bundy & Bunger	222	2.67	1.93	591
July 24	Bunger & Hezmalhalch	244	3.07	2.16	750
July 31	Bundy & Bunger	182	1.87	1.46	341
Aug. 7	Bundy & Bunger	143	1.51	1.15	216
Aug. 14	Bundy & Grieve	86	2.51	1.28	216
Aug. 21	Bundy & Bunger	101	2.27	1.35	230
Aug. 28	C. C. Hezmalhalch	119	2.04	1.40	242
Sept. 11	Bunger & Hezmalhalch	82	1.98	1.21	160
Sept. 16	F. Cogswell	84	1.36	1.00	114
Oct. 2	Bunger & Hezmalhalch	69	1.61	1.03	111
Oct. 30	C. C. Hezmalhalch	68	1.31	0.89	89
Dec. 4	Grieve & Bunger	60	1.18	0.74	71
1912 Jan. 8	Grieve & Bunger	60.7	1.11	0.70	67
Feb. 7	C. E. Turner	67	1.49	0.90	99
Mar. 18	Chatfield & Bunger	69	1.61	1.05	111
Apr. 8	Thos. Grieve, Jr.	83	1.96	1.10	163
May 6	C. C. Hezmalhalch	60	0.73	0.60	44
May 15	M. E. Bunger	183	3.06	2.08	561
May 20	Grieve & Bunger	284	3.44	2.48	976
May 29	Grieve & Bundy	96	2.17	1.17	208
June 10	Grieve & Bunger	289	3.42	2.46	988
July 1	Grieve & Bunger	439	4.31	2.95	1,893
July 8	Grieve & Bunger	216	2.48	1.32	536
July 15	Bundy & Turner	448	4.28	2.88	1,915
July 26	Grieve & Turner	326	4.99	1.25	1,628
July 30	Hewitt, Hezmalhalch & Turner	325	5.08	0.55	1,645
Aug. 2	Grieve, Hewitt & Hezmalhalch	454	6.47	1.22	2,941
Aug. 5	M. E. Bunger	284	3.87	—0.20	1,098
Aug. 9	Bundy & Hezmalhalch	197	2.96	—0.92	584
Aug. 16	Hezmalhalch & Turner	198	3.36	—0.76	666
Aug. 22	Bunger & Turner	156	2.90	—1.40	452
Sept. 9	M. E. Bunger	97	1.70	—2.25	165
Sept. 26	Grieve & Hezmalhalch	120	2.61	—1.85	313
Oct. 14	M. E. Bunger	108	1.96	—2.01	212
Nov. 6	Bunger & Hezmalhalch	136	2.36	—1.79	321

DISCHARGE OF SOUTH PLATTE RIVER AT DENVER FOR 1911

Drainage Area, 3,840 Square Miles. Altitude, 5,240 Feet Above Sea Level

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	90	78	102	115	70	205	268	390	250	165	135	100	100	
2	90	65	85	128	55	188	335	510	230	165	100	90	135	
3	90	65	85	140	90	170	312	815	215	250	110	90	100	
4	90	78	60	102	170	140	290	780	215	250	90	82	75	
5	102	115	95	90	188	155	268	450	250	195	135	82	100	
6	78	150	110	90	205	155	290	475	250	195	180	82	90	
7	78	150	80	115	245	170	225	760	215	195	165	90	122	
8	65	168	80	102	245	188	268	640	145	165	122	90	150	
9	65	150	80	90	155	205	290	680	165	165	110	90	135	
10	102	168	90	102	132	225	290	630	160	150	100	82	100	
11	102	150	105	115	132	225	245	602	650	122	110	75	100	
12	102	132	105	90	102	205	245	540	570	122	100	75	90	
13	115	132	105	70	90	188	225	570	520	122	82	110	75	
14	102	150	105	80	102	205	245	602	195	110	82	122	75	
15	65	132	100	62	102	205	245	602	212	122	90	122	90	
16	78	115	85	70	90	245	360	770	195	135	100	122	90	
17	78	132	95	70	90	245	532	890	180	100	100	135	100	
18	78	132	95	70	80	245	630	810	180	90	100	100	110	
19	90	115	110	55	80	205	335	378	195	100	100	90	110	
20	102	115	90	70	70	290	345	378	195	100	110	82	100	
21	90	115	55	62	80	245	350	455	195	100	90	82	90	
22	90	115	50	62	80	245	470	428	195	90	82	68	90	
23	90	90	50	62	90	188	455	428	270	90	100	68	100	
24	90	115	115	70	102	205	435	735	432	82	90	75	100	
25	102	132	170	70	128	188	390	770	460	90	90	90	90	
26	102	150	155	55	115	205	370	770	490	82	82	82	82	
27	102	150	140	70	115	225	400	700	355	90	100	82	62	
28	90	115	115	62	128	188	400	602	230	100	90	68	68	
29	90	115	....	62	140	205	400	510	195	100	90	68	90	
30	90	115	....	55	225	245	365	428	195	110	100	82	90	
31	90	115	....	70	....	225	....	332	165	....	90	....	90	
Total	2,788	3,819	2,697	2,526	3,696	6,423	10,278	18,430	8,360	3,952	3,225	2,676	2,999	Year 1911
Mean	90	123	96	81	123	207	343	595	270	132	104	89	98	189
Maximum	102	168	170	140	245	290	630	890	650	250	180	135	150	890
Minimum	65	65	50	55	55	140	225	332	145	82	82	68	62	50
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	5,534	7,575	5,349	5,010	7,331	12,740	20,386	36,555	16,600	7,839	6,397	5,308	5,948	137,040
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....

DISCHARGE OF SOUTH PLATTE RIVER AT DENVER FOR 1912

Drainage Area, 3,840 Square Miles. Altitude, 5,240 Feet Above Sea Level

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	80	50	50	75	40	495	1,840	2,290	388	255	205	....	
2	80	72	60	65	45	318	1,640	2,845	288	222	205	....	
3	65	65	70	65	50	295	1,350	2,070	255	205	222	....	
4	65	40	65	118	75	495	1,042	1,605	205	240	255	....	
5	80	65	65	130	65	555	845	1,090	158	175	175	....	
6	80	80	65	168	45	615	640	825	175	205	205	....	
7	65	100	70	118	45	555	580	825	205	190	288	....	
8	65	72	70	118	45	685	550	695	222	158	305	....	
9	65	60	60	95	40	1,110	395	670	205	140	340	....	
10	72	60	65	65	142	1,110	318	570	270	122	340	....	
11	90	50	70	65	195	1,150	285	540	288	270	405	....	
12	80	60	70	65	168	650	270	522	305	340	440	....	
13	100	60	65	65	280	275	255	522	305	255	405	....	
14	80	60	60	65	435	220	1,445	522	255	240	388	....	
15	65	65	60	58	532	318	1,920	570	340	240	370	....	
16	65	65	95	58	540	205	1,000	670	455	222	340	....	
17	65	65	115	75	670	555	890	695	440	205	370	....	
18	58	65	125	85	800	950	725	645	388	205	305	....	
19	72	60	190	95	930	1,090	600	588	270	190	175	....	
20	72	55	260	105	990	1,460	550	522	240	190	190	....	
21	65	55	140	85	830	1,460	550	470	322	270	175	....	
22	65	60	90	85	755	1,265	600	440	305	270	205	....	
23	58	65	90	85	650	1,130	650	370	288	288	158	....	
24	58	80	80	58	525	990	810	305	240	270	175	....	
25	65	55	80	58	555	1,055	1,000	340	240	288	175	....	
26	65	60	90	65	468	1,080	1,630	405	240	288	175	....	
27	65	65	90	50	440	1,100	1,680	340	240	288	175	....	
28	58	70	70	45	340	1,210	1,325	340	240	190	175	....	
29	72	50	95	40	238	1,790	1,250	355	190	158	175	....	
30	65	....	95	40	275	2,030	1,645	322	270	158	175	....	
31	65	....	75	....	555	....	1,835	455	....	158	....	....	
Total	2,165	1,829	2,745	2,364	11,763	26,216	30,115	23,423	8,232	6,895	7,691	....	Period
Mean	70	63	89	79	379	874	971	756	274	222	256	....	368
Maximum	100	100	260	168	990	2,030	1,920	2,845	455	340	440	....	2,845
Minimum	58	40	50	40	40	205	255	305	158	122	158	....	40
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	4,294	3,628	5,444	4,689	23,332	52,000	59,733	46,460	16,328	13,676	15,255	....	244,840
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....

NOTE.—Maximum discharge July 14, 8,700 second-feet, due to flood down Cherry Creek.

SOUTH PLATTE RIVER AT KERSEY

This station is maintained in co-operation with the United States Geological Survey and is located on a pile bridge one and one-half miles north of Kersey.

The equipment consists of two chain gauges which are owned by the United States Geological Survey.

The bed of the stream is composed of sand and gravel and is very shifting.

The observer is Mrs. J. C. Maisner, whose salary is $6.00 per month.

DISCHARGE MEASUREMENTS OF SOUTH PLATTE RIVER AT KERSEY

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
	CHANNEL NO. 1				
1911 Jan. 30	R. H. Fletcher	84	1.89	2.78	160
Feb. 25	E. O. Christiansen	74	1.70	2.58	125
Mar. 4	R. H. Fletcher	86	2.45	2.98	188
Mar. 27	R. H. Fletcher	46	1.76	2.38	81
Apr. 20	R. H. Fletcher	28	1.32	1.98	37
May 27	R. C. Miles	28	1.53	1.96	43
June 27	E. O. Christiansen	32	1.47	2.11	47
July 13	G. H. Russell	35	1.69	2.15	59
Aug. 14	R. H. Fletcher	40	1.69	2.27	68
Sept. 14	G. H. Russell	33	1.62	2.13	54
Oct. 31	G. H. Russell	66	2.11	2.80	140
Dec. 13	R. H. Fletcher	71	2.16	2.80	154
	CHANNEL NO. 2				
1911 Jan. 30	R. H. Fletcher	108	2.46	2.74	263
Feb. 25	E. O. Christiansen	127	2.18	2.65	277
Mar. 4	R. H. Fletcher	128	2.45	3.04	338
Mar. 27	R. H. Fletcher	77	2.93	2.30	149
Apr. 20	R. H. Fletcher	21	1.28	1.36	27
May 27	R. C. Miles	19	1.71	1.40	32
June 27	E. O. Christiansen	31	1.77	1.74	55
July 13	G. H. Russell	43	1.84	1.90	78
Aug. 14	R. H. Fletcher	45	2.13	2.25	96
Sept. 14	G. H. Russell	22	1.71	1.63	38
Oct. 31	G. H. Russell	88	2.67	2.90	234
Dec. 13	R. H. Fletcher	94	2.09	2.82	197
	CHANNEL NO. 1				
1912 Jan. 17	G. H. Russell	72.5	2.41	2.92	175
Jan. 17	C. E. Turner	69.1	2.52	2.92	174
Feb. 13	G. H. Russell	64.2	2.16	2.80	139
Mar. 6	G. H. Russell	60.4	2.07	2.72	127
Mar. 28	M. E. Bunger	99	2.28	3.20	226
May 8	M. E. Bunger	36	1.61	2.20	58
May 21	Robert Follansbee	183	2.19	3.80	400
June 26	H. B. Waha	398	2.86	5.35	1,140
Aug. 17	Robert Follansbee	40.3	1.98	2.50	79.8
Aug. 27	R. Richards	36.2	1.98	2.40	71.7
Oct. 30	R. Richards	89	2.90	3.19	258
Nov. 20	M. E. Bunger	165	2.43	3.56	401
	CHANNEL NO. 2				
1912 Jan. 17	G. H. Russell	95.3	2.70	3.02	257
Feb. 13	G. H. Russell	85	2.74	2.78	233
Mar. 6	G. H. Russell	81	2.58	2.73	209
Mar. 28	M. E. Bunger	145	2.47	3.20	358
May 8	M. E. Bunger	57	1.95	2.20	111
May 21	Robert Follansbee	315	1.97	3.71	621
June 26	H. B. Waha	1,830	1.33	5.31	2,440
Aug. 17	Robert Follansbee	48.4	2.36	2.50	114
Aug. 27	R. Richards	30.6	1.69	2.14	51.6
Oct. 30	R. Richards	114	2.94	3.20	335
Nov. 20	M. E. Bunger	262	2.07	3.56	541

DISCHARGE OF SOUTH PLATTE RIVER AT KERSEY FOR 1911

Drainage Area, 9,500 Square Miles. Altitude, 4,612 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	378	404	469	502	213	82	113	128	88	86	97	350	393	
2	382	428	469	512	203	86	115	129	135	130	97	307	398	
3	304	430	442	652	199	79	118	140	135	134	97	280	393	
4	277	430	430	648	200	76	82	152	135	134	97	270	381	
5	269	430	415	518	200	81	82	270	135	130	105	280	381	
6	277	430	415	488	183	81	82	722	133	130	110	280	376	
7	333	430	415	370	170	76	82	451	133	130	107	290	347	
8	404	430	415	349	170	91	100	404	133	107	105	318	355	
9	404	435	415	294	249	88	100	399	87	90	107	371	355	
10	404	460	390	270	146	89	103	364	125	90	107	420	342	
11	404	460	367	270	132	80	119	276	109	89	202	420	342	
12	404	460	328	259	121	66	101	215	112	103	295	622	334	
13	404	460	323	243	97	100	117	139	158	84	398	552	342	
14	352	460	318	236	99	79	130	125	143	83	425	541	331	
15	319	465	303	226	94	89	234	122	113	85	434	574	343	
16	282	465	292	227	97	95	340	115	102	83	447	574	338	
17	296	496	285	224	125	68	274	115	103	85	447	534	342	
18	282	480	285	218	121	67	320	115	103	83	427	636	342	
19	282	513	288	217	73	71	209	155	102	83	427	552	354	
20	262	476	310	211	69	71	147	229	102	86	427	477	354	
21	262	469	298	212	62	75	174	136	107	86	427	636	359	
22	262	469	311	198	64	72	209	134	107	86	427	718	420	
23	304	469	333	198	64	111	213	116	130	90	447	428	398	
24	343	469	358	199	64	113	193	110	130	90	388	388	379	
25	352	469	383	199	64	125	133	108	130	107	296	355	367	
26	352	469	420	213	62	75	129	110	108	136	290	342	371	
27	352	469	445	231	64	76	108	105	124	134	342	343	366	
28	363	469	473	235	110	79	106	105	169	131	342	376	366	
29	352	442	....	241	75	82	105	112	153	94	354	355	366	
30	352	442	....	241	81	82	126	140	148	94	366	360	366	
31	374	463	....	224	....	90	....	107	118	....	371	....	366	
Total	10,387	14,141	10,395	9,325	3,671	2,595	4,459	6,048	3,810	3,073	9,008	12,949	11,267	Year 1911
Mean	335	456	371	301	122	84	149	195	123	102	291	432	363	249
Maximum	404	513	473	652	249	125	340	722	169	136	447	718	420	722
Minimum	262	404	285	198	62	66	82	105	88	83	97	270	331	62
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	20,602	28,048	20,618	18,496	7,281	5,147	8,844	11,996	7,557	6,095	17,867	25,684	22,348	179,982
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....

NOTE.—Ice conditions Jan. 1-14, Feb. 21-27, Dec. 28-31. Discharge estimated.

DISCHARGE OF SOUTH PLATTE RIVER AT KERSEY FOR 1912

Drainage Area, 9,500 Square Miles. Altitude, 4,612 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	366	317	257	426	281	187	3,900	3,585	145	731	616	....	
2	366	317	264	403	264	297	4,395	3,890	139	731	638	....	
3	348	311	298	380	232	210	4,085	4,020	139	693	616	....	
4	348	332	307	350	250	159	3,835	3,807	139	655	638	....	
5	365	311	329	338	250	176	3,955	3,425	139	616	616	....	
6	354	312	329	338	235	187	3,558	2,350	139	566	616	....	
7	354	322	320	298	192	402	2,490	1,478	139	547	616	....	
8	364	346	338	298	169	427	2,490	1,188	139	517	582	....	
9	364	351	298	298	183	765	2,220	962	159	517	566	....	
10	364	336	320	298	187	1,745	1,810	735	187	551	547	....	
11	316	362	350	281	268	2,085	1,358	601	274	584	547	....	
12	364	362	338	264	496	1,512	789	473	333	584	716	....	
13	301	362	329	298	621	1,135	517	312	353	600	826	....	
14	290	362	320	264	936	642	492	252	506	638	776	....	
15	362	362	298	257	1,236	406	1,358	210	761	638	776	....	
16	390	362	309	241	1,977	488	4,115	195	1,020	638	776	....	
17	418	362	350	232	2,260	687	4,330	195	955	638	776	....	
18	431	362	362	282	1,787	1,875	2,878	227	955	638	866	....	
19	388	362	406	320	1,358	2,775	2,490	590	891	600	866	....	
20	340	329	583	375	1,213	1,598	2,245	314	861	600	968	....	
21	296	338	855	375	1,057	1,620	2,130	254	811	638	991	....	
22	285	338	665	362	780	1,640	2,108	201	770	659	1,104	....	
23	306	329	595	406	687	1,712	2,465	166	730	676	1,104	....	
24	332	350	561	406	549	2,085	2,072	160	693	638	1,141	....	
25	390	362	543	406	421	2,800	2,015	146	701	638	1,079	....	
26	418	338	561	406	312	3,415	1,692	139	726	616	968	....	
27	418	309	573	393	259	3,505	1,915	133	726	616	926	....	
28	390	338	573	371	220	3,780	2,800	153	687	616	926	....	
29	365	307	531	371	187	3,558	2,450	127	687	582	926	....	
30	352	....	531	309	162	3,350	1,985	127	687	616	958	....	
31	327	....	642	....	150	....	2,695	139	....	638	....	....	
Total	11,072	9,851	13,335	10,046	19,179	45,223	77,637	30,554	15,681	19,215	24,067	....	Period
Mean	357	340	430	335	619	1,507	2,504	986	523	620	802	....	823
Maximum	431	362	855	426	2,260	3,780	4,395	4,020	1,020	731	1,141	....	4,395
Minimum	285	307	257	232	150	159	492	127	139	517	547	....	127
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	21,961	19,540	26,450	19,922	38,041	89,700	153,993	60,604	31,104	38,112	47,737	....	547,168
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....

NOTE.—Ice conditions Jan. 1-10. Discharge estimated.

SOUTH PLATTE RIVER AT JULESBURG

This station is maintained in co-operation with the United States Geological Survey.

It is located on a pile bridge one mile south of Julesburg and about one mile from the Colorado-Nebraska line.

The bed of the stream is sandy and very shifting. There are several small channels at low water.

The observer is Elva McSparran, whose salary is $4.00 per month.

DISCHARGE MEASUREMENTS OF SOUTH PLATTE RIVER AT JULESBURG

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 31*	R. H. Fletcher	345	1.95	2.46	683
Mar. 28	R. H. Fletcher	29	1.34	1.10	39
Apr. 21	R. H. Fletcher	14	1.18	0.96	16
May 26	R. C. Miles	21	0.85	0.90	18
June 28	E. O. Christiansen	8.4	0.89	0.90	7.5
July 14	G. H. Russell	5.1	0.90	0.85	4.5
Aug. 15	R. H. Fletcher	6.8	1.05	at start 0.85	7.2
Sept. 15	G. H. Russell	13	0.99	0.82	13
Oct. 31	G. H. Russell	19	1.53	1.07	29
Dec. 14	R. H. Fletcher	17	1.06	1.04	18
1912 Jan. 15*	G. H. Russell	51	1.53	1.75	78
Feb. 12*	G. H. Russell	158	2.32	1.95	366
Mar. 5*	G. H. Russell	108	1.56	2.20	168
May 7	M. E. Bunger	47	1.53	1.15	73
May 22	Robert Follansbee	84	1.68	1.58	141
June 27	H. B. Waha	10	1.25	0.52	13
July 26	F. Cogswell	7.8	1.78	0.65	14
Aug. 3	F. Cogswell	386	2.07	2.80	798
Aug. 22	Robert Follansbee	212	1.54	2.09	326
Aug. 28	F. Cogswell	93	2.08	1.15	193
Oct. 29	R. Richards	108	1.94	1.52	210
Nov. 19	M. E. Bunger	196	2.11	1.92	413

*Ice conditions.

DISCHARGE OF SOUTH PLATTE RIVER AT JULESBURG FOR 1911

Drainage Area, 20,600 Square Miles. Altitude, 3,469 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	23	230	680	670	34	75	21	8	8	21	8	34	21	
2	40	230	675	670	34	52	21	8	8	21	8	34	21	
3	40	230	670	670	34	52	12	8	8	21	8	34	21	
4	40	300	670	670	34	52	12	8	8	21	12	34	21	
5	40	350	670	142	34	52	12	8	8	21	12	34	21	
6	65	350	670	195	34	34	12	8	8	21	12	34	21	
7	100	350	670	195	34	34	12	8	8	12	12	34	19	
8	100	700	670	195	21	34	12	8	8	12	12	34	19	
9	100	700	510	142	21	34	12	8	8	12	21	34	19	
10	100	700	670	105	21	21	12	8	8	12	21	34	19	
11	40	700	510	105	21	21	12	8	8	12	21	34	19	
12	200	700	510	75	21	21	12	8	8	12	21	34	19	
13	240	700	510	75	21	21	12	8	8	12	21	34	19	
14	240	700	375	52	21	12	12	8	8	12	21	21	18	
15	240	700	375	52	21	12	21	8	8	8	21	21	18	
16	260	700	270	52	21	12	75	8	8	8	21	21	18	
17	260	700	270	34	21	12	52	8	8	8	21	21	18	
18	260	700	195	34	21	12	34	8	25	8	21	21	18	
19	240	700	195	34	21	12	21	8	270	8	21	21	18	
20	240	700	195	34	21	12	21	12	270	8	21	21	18	
21	260	700	195	34	12	12	12	21	195	8	21	21	18	
22	260	700	142	34	21	12	12	21	142	8	21	21	18	
23	260	700	142	34	21	12	12	21	105	8	21	21	18	
24	260	700	142	34	21	12	8	21	105	8	21	21	18	
25	260	700	375	21	21	12	8	21	105	8	21	21	18	
26	260	700	670	34	21	12	8	21	105	8	21	21	18	
27	260	685	670	21	21	12	8	12	75	8	34	21	18	
28	240	685	670	52	12	12	8	12	52	8	34	21	18	
29	240	685	....	52	40	21	8	8	52	8	34	21	18	
30	260	685	....	52	75	21	8	7	34	8	34	21	18	
31	260	685	....	34	....	21	....	8	21	....	34	....	18	
Total	5,688	18,765	12,966	4,603	776	746	502	337	1,692	350	632	799	565	Year 1911
Mean	183	605	463	148	26	24	17	11	55	12	20	27	18	117
Maximum	260	700	680	670	75	75	75	21	270	21	34	34	21	700
Minimum	23	230	142	21	12	12	8	7	8	8	8	21	18	7
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	11,282	37,220	25,718	9,130	1,539	1,480	996	668	3,356	694	1,254	1,585	1,121	84,761
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....	....

NOTE.—Ice conditions Jan. 3-Feb. 1, Feb. 18-Mar. 4, Dec. 3-31. Discharge estimated.

DISCHARGE OF SOUTH PLATTE RIVER AT JULESBURG FOR 1912

Drainage Area, 20,600 Square Miles. Altitude, 3,469 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	20	320	170	574	161	38	8	148	100	741	292	....	
2	20	320	170	506	148	38	8	506	95	705	269	....	
3	20	320	168	443	....	38	8	720	90	669	245	....	
4	20	320	168	414	....	38	44	960	75	669	245	....	
5	20	320	168	358	....	28	126	1,126	70	633	245	....	
6	30	340	200	332	....	28	126	1,169	55	597	245	....	
7	30	340	200	308	69	28	126	1,126	55	530	245	....	
8	30	340	200	284	....	28	137	1,001	60	497	269	....	
9	50	340	200	284	....	28	174	1,126	65	463	269	....	
10	50	365	200	284	....	28	174	878	105	463	292	....	
11	50	365	200	284	....	28	148	838	200	432	292	....	
12	50	365	200	284	161	28	126	798	230	401	318	....	
13	50	365	200	284	148	28	90	720	265	344	292	....	
14	75	340	200	284	148	28	56	720	385	318	292	....	
15	78	340	200	284	148	28	50	647	463	292	318	....	
16	80	270	200	263	137	28	38	574	463	245	344	....	
17	100	270	270	242	126	28	38	506	497	203	401	....	
18	105	270	270	223	126	33	28	443	597	203	401	....	
19	140	270	270	204	137	33	24	358	669	165	432	....	
20	150	270	270	242	126	33	20	358	669	165	432	....	
21	150	200	270	242	126	33	20	345	741	203	401	....	
22	150	200	620	204	126	24	16	332	818	203	401	....	
23	150	200	620	204	106	16	16	240	818	245	401	....	
24	160	200	620	223	106	13	16	265	818	245	401	....	
25	180	170	620	223	90	13	16	295	818	245	401	....	
26	200	170	620	204	62	12	16	265	818	245	401	....	
27	200	170	620	204	62	12	16	255	779	245	432	....	
28	200	170	647	204	62	8	8	235	779	245	432	....	
29	300	170	647	189	62	8	20	245	779	245	432	....	
30	300	....	720	174	62	8	30	165	741	245	432	....	
31	300	....	574	....	50	....	38	165	....	245	....	....	
Total	3,458	8,100	10,702	8,452	2,549	762	1,761	17,529	13,117	11,346	10,272	....	Period
Mean	112	279	345	282	111	25	57	565	437	366	342	....	269
Maximum	300	365	720	574	161	38	174	1,169	818	741	432	....	1,169
Minimum	20	170	168	174	50	8	8	148	55	165	245	....	8
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	6,859	16,066	21,227	16,765	5,056	1,511	3,493	34,769	26,018	22,505	20,374	....	174,643
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....

NOTE.—Ice conditions Jan. 1-Mar. 26. Discharge estimated.

GENEVA CREEK NEAR GRANT

This station is maintained by the United States Geological Survey and is located at Sullivan's ranch about two miles above Grant.

The equipment consists of a staff gauge only.

The bed of the stream is rough, being composed of large and medium sized boulders.

The observer was Mrs. M. A. Sullivan, who was paid $5.00 per month.

DISCHARGE MEASUREMENTS OF GENEVA CREEK NEAR GRANT

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 9*	Couch & Fletcher	20	0.73	0.50	15
Feb. 21*	R. H. Fletcher	15	1.03	0.40	15
Mar. 14*	R. H. Fletcher	16	0.86	0.48	14
Apr. 14	W. B. Freeman	17	0.82	0.47	14
June 11	J. B. Stewart	50	3.64	1.50	182
July 13	W. B. Freeman	46	3.11	1.40	143
Aug. 29	R. H. Fletcher	26	1.53	0.80	41
Nov. 2	G. H. Russell	22	1.20	0.72	26

*Ice conditions.

DISCHARGE OF GENEVA CREEK AT SULLIVAN'S RANCH NEAR GRANT FOR 1911

Drainage Area, 49 Square Miles. Altitude, 8,566 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	15	15	14	15	33	226	124	66	32	66	29	11	
2	....	15	15	14	15	31	202	250	66	36	51	26	11	
3	....	15	15	14	15	28	190	276	66	38	32	38	11	
4	....	15	15	14	14	33	214	232	66	44	27	30	11	
5	....	15	15	14	12	67	214	294	51	38	51	30	11	
6	....	15	15	14	12	67	202	276	51	38	38	30	11	
7	....	15	15	14	12	94	226	260	51	32	32	30	11	
8	....	15	15	14	12	114	226	217	51	32	32	30	11	
9	....	15	15	14	12	145	143	178	51	32	38	20	11	
10	....	15	15	14	15	94	152	154	51	32	27	20	11	
11	....	15	15	14	15	67	152	154	66	32	27	20	11	
12	....	15	15	14	15	89	214	142	66	30	27	20	11	
13	....	15	15	14	14	114	190	132	51	27	27	20	11	
14	....	15	15	14	14	124	202	121	48	32	27	20	11	
15	....	15	15	14	28	124	190	121	44	38	27	15	11	
16	....	15	15	14	21	145	190	121	51	27	27	15	11	
17	....	15	15	14	15	156	190	142	48	27	27	15	11	
18	....	15	15	14	15	190	130	121	51	27	27	15	11	
19	....	15	15	14	25	167	86	121	51	27	27	15	11	
20	....	15	15	14	27	134	190	121	48	32	27	15	11	
21	....	15	15	14	33	130	214	102	51	32	27	15	11	
22	....	15	15	10	31	124	165	117	58	30	27	15	11	
23	....	15	15	10	33	130	152	102	66	27	27	15	11	
24	....	15	15	10	23	145	202	102	51	27	30	15	11	
25	....	15	15	10	28	145	178	92	51	27	30	15	11	
26	....	15	15	10	31	152	167	92	38	27	30	15	11	
27	....	15	15	10	45	167	167	83	38	27	32	15	11	
28	....	15	15	10	45	156	156	70	38	27	32	15	11	
29	....	15	....	10	48	178	134	83	38	38	32	15	11	
30	....	15	....	10	39	167	134	74	36	44	32	12	11	
31	....	15	....	12	....	178	....	66	32	....	32	....	11	
Total	....	465	420	396	679	3,688.	5,398	4,540	1,591	959	995	600	341	Year
Mean	....	15	15	13	23	119	180	146	51	32	32	20	11	55
Maximum	....	15	15	14	48	178	226	294	66	44	66	38	11	294
Minimum	....	15	15	10	12	28	86	66	32	27	27	12	11	10
Run-off per square mile	....	0.306	0.306	0.265	0.469	2.429	3.673	2.980	1.041	0.653	0.653	0.408	0.224	1.122
Run-off, depth, inches	....	0.353	0.319	0.306	0.523	2.801	4.098	3.436	1.200	0.728	0.753	0.455	0.258	15.230
Run-off, acre-feet	....	922	833	787	1,347	7,315	10,707	9,005	3,156	1,902	1,974	1,190	676	39,812
Acre-feet per square mile	....	18.82	17.00	16.06	27.49	149.18	218.51	183.78	64.41	38.82	40.29	24.29	13.80	812.49

NOTE.—Discharge estimated Jan.-Mar. 22, Nov. 3-Dec. 31.

SOUTH BOULDER CREEK AT ELDORADO SPRINGS

This station is located at the Eldorado Springs resort about three miles west of Marshall.

The equipment consists of a 4" x 4" slope gauge. Measurements are made from a highway bridge just below the gauge.

The bed of the stream is composed of gravel and boulders and shifts in high stages.

The observer is B. E. Chesebro, who is paid $3.00 per month.

DISCHARGE MEASUREMENTS OF SOUTH BOULDER CREEK AT ELDORADO SPRINGS

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 10	C. E. Turner	4	0.25	0.71	1
	Mar. 10	C. E. Turner	14	1.14	1.16	16
	Mar. 10	C. E. Turner	21	0.81	1.16	17
	Apr. 13	C. E. Turner	10	1.31	1.12	13
	May 19	C. E. Turner	54	3.86	2.20	207
	June 8	C. C. Hezmalhalch	55	4.17	2.25	230
	Aug. 2	C. C. Hezmalhalch	21	1.63	1.30	34
	Aug. 23	C. C. Hezmalhalch	34	2.34	1.80	80
	Sept. 15	Grieve & Hezmalhalch	12	1.42	1.15	17
	Dec. 15	C. E. Turner	6	1.14	0.92	7
1912	Jan. 19	C. E. Turner	2.6	0.38	0.58	0.98
	Mar. 8	C. E. Turner	3.0	0.40	0.60	1.2
	Apr. 12	C. E. Turner	7.4	1.26	1.00	9.3
	May 16	Bunger & Bundy	22	0.88	1.20	19
	May 19	C. E. Turner	50	3.02	2.10	152
	June 4	Thos. Grieve, Jr.	60	4.22	2.45	253
	Aug. 10	D. L. Bundy	31	1.81	1.60	56
	Sept. 27	D. L. Bundy	23	1.60	1.35	36

DISCHARGE OF SOUTH BOULDER CREEK AT ELDORADO SPRINGS FOR 1911

Drainage Area, 125 Square Miles. Altitude, 5,800 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	6	4	2	6	20	58	246	104	48	21	20	20	14	
2	6	4	2	8	20	52	316	153	43	18	20	9	14	
3	8	4	2	9	20	58	316	212	44	25	14	17	14	
4	11	4	2	9	20	66	246	231	44	25	17	17	12	
5	3	4	2	9	24	66	292	212	38	25	14	14	12	
6	3	4	2	9	20	84	269	231	38	21	24	14	9	
7	3	4	2	12	20	117	246	212	33	18	24	9	9	
8	6	4	2	14	20	130	269	181	29	19	20	17	9	
9	14	4	1	14	27	130	340	153	28	15	20	14	6	
10	14	4	1	14	20	159	293	127	32	16	20	14	8	
11	11	4	1	20	24	117	250	127	75	17	20	14	8	
12	14	4	1	14	24	117	250	116	66	17	20	9	6	
13	11	4	1	14	20	130	272	116	50	17	20	9	6	
14	3	4	1	14	20	144	250	140	33	17	20	12	6	
15	6	4	1	14	20	144	272	127	33	20	20	17	6	
16	8	3	2	20	20	174	272	127	32	17	14	17	8	
17	8	3	2	17	24	174	231	104	27	14	20	12	8	
18	6	3	2	20	20	191	196	104	27	14	20	12	8	
19	6	3	2	20	24	227	196	104	25	14	14	14	8	
20	6	3	4	17	27	174	196	85	24	14	14	14	8	
21	8	3	4	20	31	144	250	85	31	17	20	12	8	
22	6	3	4	20	35	130	272	85	45	14	17	12	8	
23	6	3	4	20	40	117	231	85	68	14	14	9	8	
24	8	3	7	20	35	117	181	76	50	14	14	14	8	
25	8	3	9	20	35	144	181	68	39	14	14	14	8	
26	8	2	9	20	40	159	153	68	30	12	17	12	8	
27	6	2	9	20	45	174	140	61	30	12	14	9	8	
28	6	2	6	20	58	191	140	54	27	12	14	6	8	
29	4	2	....	20	66	174	140	54	23	12	12	9	8	
30	4	2	....	20	52	208	127	54	20	14	9	14	8	
31	3	2	....	20	....	246	....	54	17	....	12	....	8	
Total	220	102	87	494	871	4,316	7,033	3,710	1,149	499	512	386	267	Year 1911
Mean	7	3.3	3.1	16	29	139	234	120	37	17	17	13	8.6	53
Maximum	14	4	9	20	66	246	340	231	75	25	24	20	14	340
Minimum	3	2	1	6	20	52	127	54	17	12	9	6	6	1
Run-off per square mile	0.057	0.026	0.025	0.128	0.232	1.112	1.872	0.960	0.296	0.136	0.136	0.104	0.007	0.426
Run-off, depth, inches	0.066	0.030	0.026	0.148	0.259	1.282	2.088	1.107	0.341	0.152	0.157	0.116	0.008	5.767
Run-off, acre-feet	437	202	173	980	1,728	8,561	13,950	7,359	2,279	990	1,016	766	530	38,534
Acre-feet per square mile	3.50	1.62	1.38	7.84	13.80	68.50	111.60	58.89	18.23	7.92	8.13	6.13	4.24	308.25

NOTE.—Discharge estimated Jan. 1-Feb. 23.

DISCHARGE OF SOUTH BOULDER CREEK AT ELDORADO SPRINGS FOR 1912

Drainage Area, 125 Square Miles. Altitude, 5,800 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	7	3	7	13	93	292	414	166	29	25	11	....	
2	7	3	7	14	104	279	353	152	25	25	19	....	
3	7	3	7	17	111	321	317	127	25	22	25	....	
4	7	3	7	25	58	357	289	105	29	13	19	....	
5	7	3	7	42	50	350	243	95	25	9	25	....	
6	7	3	7	68	49	369	217	85	22	9	13	....	
7	7	5	7	90	54	339	229	85	19	9	25	....	
8	7	5	7	90	55	382	229	77	19	13	16	....	
9	7	5	7	97	69	421	229	69	25	9	19	....	
10	3	5	7	101	50	332	229	55	43	11	19	....	
11	3	7	7	81	77	365	201	55	33	13	25	....	
12	3	7	7	63	77	328	188	55	33	19	19	....	
13	2	7	7	59	83	314	193	55	25	29	13	....	
14	2	7	7	34	122	276	278	55	33	29	19	....	
15	2	7	7	36	203	293	250	69	33	25	19	....	
16	1	7	7	33	309	260	250	69	33	29	22	....	
17	1	7	7	22	325	271	214	55	33	25	13	....	
18	1	7	7	16	290	260	203	62	33	29	19	....	
19	1	7	9	12	300	241	193	55	29	33	19	....	
20	1	7	10	12	275	230	183	43	33	25	19	....	
21	1	7	9	11	293	259	183	43	33	33	19	....	
22	1	7	8	12	327	279	173	38	25	25	13	....	
23	1	7	8	12	327	298	167	38	25	33	13	....	
24	1	7	8	12	327	380	152	38	25	29	9	....	
25	1	7	8	4	342	497	152	33	25	29	13	....	
26	3	7	8	25	294	419	152	29	25	25	13	....	
27	3	7	9	25	375	419	152	29	25	25	5	....	
28	3	7	9	43	287	458	152	25	25	25	13	....	
29	3	7	13	48	270	419	127	29	25	25	19	....	
30	3	....	16	81	314	458	127	29	25	25	19	....	
31	3	....	10	....	406	....	152	38	....	25	....	....	
Total	106	171	251	1,198	6,316	10,175	6,591	1,958	837	700	514	....	Period
Mean	3.4	5.9	8.1	40	204	339	213	63	28	23	17	....	86
Maximum	7	7	16	101	406	458	414	166	43	33	25	....	458
Minimum	1	3	7	4	49	230	127	25	19	9	5	....	1
Run-off per square mile	0.027	0.047	0.065	0.320	1.632	2.712	1.704	0.504	0.224	0.184	0.136	....	0.688
Run-off, depth, inches	0.031	0.051	0.075	0.357	1.881	3.026	1.964	0.581	0.250	0.212	0.152	....	8.580
Run-off, acre-feet	210	339	498	2,376	12,528	20,182	13,073	3,884	1,660	1,388	1,020	....	57,158
Acre-feet per square mile	1.68	2.71	3.98	19.01	100.22	161.46	104.58	31.07	13.28	11.10	8.16	....	457.25

NOTE.—Discharge estimated Jan. 1-Mar. 16. Flow of Community Ditch included.

CLEAR CREEK AT FORKSCREEK

This station, located about fifty feet from the Colorado & Southern depot at Forkscreek, is maintained by the United States Geological Survey in co-operation with the State.

The equipment consists of a foot-bridge and chain gauge which belong to the United States Geological Survey.

The bed of the stream is composed of small cobbles and boulders and is extremely shifting.

The observer was C. W. Hoisington, who was paid $5.00 per month.

DISCHARGE MEASUREMENTS OF CLEAR CREEK AT FORKSCREEK

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 3*	Miles & Fletcher	43	0.52	7.37	23
Mar. 1*	R. H. Fletcher	20	1.45	7.33	28
Mar. 1*	R. H. Fletcher	20	1.23	6.73	24
Mar. 24	Miles & Fletcher	16	1.98	5.94	32
Mar. 24	R. H. Fletcher	21	1.99	5.98	41
May 13	J. B. Stewart	71	4.05	6.70	286
June 29	E. O. Christiansen	106	5.07	7.00	537
Aug. 22	R. H. Fletcher	67	4.10	6.10	274
Sept. 23	G. A. Gray	44	1.96	5.62	86
Nov. 8	G. H. Russell	30	2.69	5.80	81
Dec. 22	R. H. Fletcher	32	1.28	7.40	41

*Ice conditions.

DISCHARGE OF CLEAR CREEK AT FORKSCREEK FOR 1911

Drainage Area, 345 Square Miles. Altitude, 6,893 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	23	24	26	83	110	670	432	255	128	103	67	55	
2	....	23	24	26	70	96	738	833	216	128	76	67	55	
3	....	23	24	26	58	96	825	965	220	215	76	67	27	
4	....	23	24	26	58	125	882	970	185	177	76	67	27	
5	....	23	24	26	83	125	835	945	181	160	73	57	33	
6	....	23	24	26	70	179	837	1,010	155	160	73	65	45	
7	....	23	24	26	58	286	780	860	158	112	73	65	45	
8	....	23	24	26	47	286	782	740	143	112	80	81	45	
9	....	23	24	28	70	332	750	680	146	112	80	81	45	
10	....	23	24	28	58	386	752	595	202	97	68	81	45	
11	....	23	24	28	70	309	690	540	242	97	78	50	45	
12	....	23	24	28	70	240	784	545	245	96	78	40	45	
13	....	23	24	28	70	286	814	515	248	95	84	55	45	
14	....	23	24	30	47	286	820	435	252	94	84	55	41	
15	....	23	25	18	30	338	790	442	217	93	84	63	41	
16	....	23	25	18	47	340	730	390	219	92	58	50	41	
17	....	23	25	18	47	397	640	365	221	91	64	63	41	
18	....	23	25	24	58	400	580	373	223	90	64	50	41	
19	....	23	25	38	70	460	610	375	205	88	69	50	41	
20	....	23	25	47	70	375	708	378	188	87	80	63	41	
21	....	23	25	24	70	355	865	357	191	85	80	63	41	
22	....	23	25	83	96	305	900	363	193	83	79	63	41	
23	....	23	25	58	96	260	770	367	195	80	67	63	41	
24	....	23	25	47	96	305	712	370	175	80	67	55	41	
25	....	23	25	58	96	360	652	350	175	79	67	45	41	
26	....	23	25	30	125	420	590	327	160	78	70	55	41	
27	....	23	25	18	138	422	533	330	160	78	70	63	35	
28	....	23	25	58	160	480	535	333	160	78	69	63	35	
29	....	23	....	70	198	510	480	290	143	77	69	55	35	
30	....	23	....	83	125	545	455	292	143	77	52	55	35	
31	....	23	....	83	....	545	....	252	127	....	67	....	35	
Total	....	713	686	1,153	2,434	9,959	21,509	16,019	5,943	3,119	2,278	1,817	1,265	Year
Mean	....	23	24	37	81	321	717	517	192	104	73	61	41	183
Maximum	....	23	25	83	198	545	900	1,010	255	215	103	81	55	1,010
Minimum	....	23	24	18	30	96	455	252	127	77	52	40	27	23
Run off per square mile	....	0.067	0.070	0.107	0.235	0.930	2.078	1.500	0.556	0.301	0.212	0.177	0.119	0.530
Run-off, depth, inches	....	0.077	0.073	0.123	0.263	1.072	2.319	1.729	0.641	0.336	0.244	0.198	0.137	7.204
Run-off, acre-feet	....	1,414	1,361	2,287	4,828	19,753	42,662	31,773	11,788	6,186	4,518	3,604	2,509	132,686
Acre-feet per square mile	....	4.10	3.94	6.63	13.99	57.24	123.65	92.10	34.17	17.93	13.09	10.45	7.27	384.60

NOTE.—Ice conditions Jan. 1-Feb. 28, Mar. 14-31. Dec. 7-31. Discharge estimated.

CLEAR CREEK NEAR GOLDEN

This station, maintained by the United States Geological Survey and The Denver Reservoir Irrigation Company, is located about two miles above Golden. It is intended to take the place of the station formerly located at Forkscreek.

The equipment consists of a Lallie automatic gauge, and cable with car.

Discharge at this station is affected by the Golden ditch which diverts water just above the station.

Records at this station were furnished by the United States Geological Survey.

DISCHARGE MEASUREMENTS OF CLEAR CREEK NEAR GOLDEN

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 Feb. 19*	Gray & Russell	29	0.92	1.06	27
Mar. 9*	Gray & Mathias	72	0.56	1.40	41
Mar. 9*	Gray & Waha	72	0.55	1.40	40
Apr. 27	G. A. Gray	32	1.83	1.06	58
May 18	J. L. Mathias	54	4.33	1.89	234
May 27	Follansbee & Gray	122	5.78	3.00	705
June 10	G. A. Gray	161	7.58	3.55	1,220
Aug. 30	R. Richards	87	2.88	1.97	250
Oct. 26	R. Richards	48	2.11	1.45	102

*Ice conditions.

DISCHARGE OF CLEAR CREEK NEAR GOLDEN FOR 1912

Drainage Area, 380 Square Miles. Altitude, 5,620 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	*32	*27	*40	42	106	880	2,070	880	218	130	102	....	
2	32	27	40	42	132	810	1,870	740	227	132	106	....	
3	32	27	40	42	140	880	1,770	650	224	132	127	....	
4	32	27	40	42	120	1,110	1,570	590	182	140	114	....	
5	32	27	40	42	90	1,290	1,200	590	167	140	110	....	
6	32	27	40	42	102	1,570	1,030	535	182	135	94	....	
7	32	27	40	42	100	1,380	1,110	535	188	132	110	....	
8	32	27	40	42	125	1,380	1,200	535	160	143	98	....	
9	32	27	40	42	160	1,380	1,290	485	203	140	92	....	
10	32	27	40	42	170	1,110	1,200	390	218	143	88	....	
11	32	27	40	42	120	1,030	1,200	370	182	135	86	....	
12	32	27	40	42	145	1,030	1,380	435	176	125	84	....	
13	32	27	40	42	120	1,030	1,200	410	160	118	86	....	
14	32	27	40	42	132	950	1,290	410	167	122	86	....	
15	32	27	40	42	170	950	1,380	410	160	130	76	....	
16	32	27	40	42	185	880	1,290	410	162	130	62	....	
17	32	27	40	42	185	880	1,110	460	162	127	60	....	
18	32	27	40	42	236	740	1,110	370	155	127	71	....	
19	32	27	40	42	310	740	1,110	357	157	122	80	....	
20	32	27	40	42	330	810	1,030	344	165	122	71	....	
21	32	27	40	42	410	950	1,110	330	152	127	68	....	
22	32	27	40	42	535	1,030	950	290	140	116	68	....	
23	32	27	40	45	590	1,380	880	275	138	122	77	....	
24	32	27	40	45	620	1,770	880	260	147	118	74	....	
25	32	27	40	45	620	1,970	880	248	140	110	78	....	
26	32	27	40	45	740	1,770	880	239	135	108	65	....	
27	32	27	40	55	740	1,970	880	215	135	114	65	....	
28	32	27	40	55	680	2,170	810	215	127	118	65	....	
29	32	27	40	60	680	2,270	880	227	118	106	65	....	
30	32	....	40	72	880	2,580	710	242	122	108	65	....	
31	32	....	40	....	950	....	740	233	....	106	....	....	
Total	992	783	1,240	1,346	10,623	38,690	36,010	12,680	4,969	3,878	2,493	....	Period
Mean	32	27	40	45	343	1,290	1,162	409	166	125	83	....	339
Maximum	32	27	40	72	950	2,580	2,070	880	227	143	127	....	2,580
Minimum	32	27	40	42	90	740	710	215	118	106	60	....	27
Run-off per square mile	0.084	0.071	0.105	0.118	0.903	3.395	3.058	1.076	0.437	0.329	0.218	....	0.893
Run-off, depth, inches	0.097	0.077	0.121	0.132	1.041	3.788	3.526	1.241	0.488	0.379	0.243	....	11.126
Run-off, acre-feet	1,968	1,553	2,459	2,670	21,071	76,742	71,426	2,515	9,856	7,692	4,945	....	225,532
Acre-feet per square mile	5.18	4.09	6.47	7.03	55.44	201.95	187.95	66.18	25.94	20.24	13.01	....	593.51

*Discharge estimated, Jan. 1-Mar. 31, from measurements.

BOULDER CREEK AT ORODELL

This station is maintained by The Central Colorado Power Company and the State. It is located just above the mouth of Four Mile creek and near Orodell station on the Denver, Boulder & Western Railroad.

The equipment is owned by The Central Colorado Power Company and consists of a cable with car, a Friez automatic gauge and 2″ x 5″ slope gauge.

Measurements at this station are made by the State hydrographers.

The expense of looking after the gauge is paid by The Central Colorado Power Company.

The bed of the stream is composed of sand and boulders and shifts at high stages.

DISCHARGE MEASUREMENTS OF BOULDER CREEK AT ORODELL

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 14*	C. L. Chatfield	4.9	0.50	2.50	2.4
	Feb. 10†	C. E. Turner	16	0.34	1.66	5.6
	Mar. 5	Chatfield & Turner	4.3	0.60	1.32	2.6
	Mar. 10	C. E. Turner	6.9	0.87	1.47	6
	Apr. 13	C. E. Turner	4.5	0.60	1.35	2.7
	Apr. 26	C. E. Turner	21	1.52	1.93	32
	May 18	C. E. Turner	65	3.18	3.00	206
	June 1	Thos. Grieve, Jr.	73	3.01	3.05	220
	June 9	C. C. Hezmalhalch	97	4.58	3.42	444
	Aug. 1	C. C. Hezmalhalch	43	1.93	2.48	83
	Aug. 22	C. C. Hezmalhalch	31	1.75	2.20	54
	Sept. 15	Hezmalhalch & Grieve	15	1.72	1.90	26
	Oct. 17	C. E. Turner	11	1.33	1.68	14
	Dec. 16	C. E. Turner	18	0.68	1.92	12
1912	Jan. 19	C. E. Turner	18	0.83	1.74	15
	Jan. 19	C. E. Turner	21	1.44	1.92	30
	Mar. 8†	C. E. Turner	28	0.54	2.22	15
	Apr. 12	C. E. Turner	12	1.29	1.76	16
	May 16	Bundy & Bunger	42	2.80	2.60	118
	May 16	C. E. Turner	39	3.02	2.60	119
	June 4	Bundy & Grieve	91	4.62	3.50	420
	July 13	D. L. Bundy	104	4.23	3.55	442
	Aug. 10	D. L. Bundy	58	2.47	2.75	145
	Sept. 23	D. L. Bundy	50	1.94	2.45	96
	Nov. 23	M. E. Bunger	26	0.88	2.05	23

*At temporary station at power house. †Ice conditions.

DISCHARGE OF BOULDER CREEK AT ORODELL FOR 1911

Drainage Area, 108 Square Miles. Altitude, 5,723 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	4	5	7	2	4	78	228	165	66	50	....	12	....	
2	5	5	6	2	5.5	93	246	194	92	44	....	12	....	
3	9	5	6	3	7	86	274	246	83	44	....	12	....	
4	6	5	7	3	10	66	220	260	77	40	....	15	....	
5	9	5	6	3.5	7	71	260	274	66	40	....	15	....	
6	8	4	5	3.5	20	92	260	260	54	40	....	15	....	
7	5	4	5	3.5	5.5	124	325	282	56	35	....	15	....	
8	5	4	5	3.5	5.5	167	380	260	50	35	....	24	....	
9	5	4	5	4	8.5	183	433	241	54	35	....	10	....	
10	8	4	6	7	10	174	423	228	78	35	....	20	....	
11	8	3	6	7	8.5	128	414	220	68	35	....	10	....	
12	8	3	5	4	5.5	100	417	214	49	31	....	10	....	
13	6	3	5	3.5	4	115	428	199	60	27	....	40	....	
14	11	2.5	5	3.5	5.5	130	413	172	66	24	....	18	....	
15	11	2.5	6	4	8	145	390	176	66	24	....	24	....	
16	11	2.5	6	3.5	10	155	388	156	54	....	....	15	....	
17	9	2.5	6	4	12	165	374	124	58	....	15	18	....	
18	9	2.5	6	3.5	15	180	360	137	56	....	15	12	....	
19	9	2.5	5	4	17	195	350	152	50	....	12	12	....	
20	9	2.5	5	4	19	211	340	128	56	....	15	8	....	
21	8	2.5	7	5.5	21	172	330	126	56	....	18	10	....	
22	8	2.5	9	5.5	22	156	320	109	56	....	....	18	....	
23	8	2.5	23	4	24	137	310	109	76	....	....	15	....	
24	7	2.5	18	4	18	122	300	118	76	....	....	27	....	
25	7	2.5	12	5.5	26	150	294	128	76	....	....	15	....	
26	7	2.5	2	15	31	190	265	118	83	....	....	24	....	
27	6	2.5	2	8.5	35	220	206	128	68	....	....	20	....	
28	6	5	2	4	62	201	201	100	68	....	12	31	....	
29	5	8	....	3.5	92	206	206	105	56	....	24	35	....	
30	5	9	....	4	78	206	190	92	44	....	10	18	....	
31	5	8	....	4	....	238	....	92	40	....	12	....	....	
Total	227	119	188	136	596	4,656	9,545	5,313	1,958	539	133	530	....	Period 1911
Mean	7.3	3.5	6.7	4.4	20	150	318	171	63	36	15	18	....	80
Maximum	11	9	23	15	92	238	433	282	92	50	24	40	....	433
Minimum	4	2.5	2	2	4	66	190	92	40	24	10	8	....	2
Run-off per square mile	0.068	0.032	0.062	0.041	0.185	1.389	2.944	1.583	0.583	0.333	0.137	0.164	....	0.741
Run-off, depth, inches	0.078	0.037	0.064	0.047	0.207	1.602	3.284	1.825	0.672	0.186	0.046	0.183	....	8.185
Run-off, acre-feet	450	236	373	270	1,182	9,235	18,932	10,538	3,884	1,069	264	1,051	....	47,034
Acre-feet per square mile	4.17	2.19	3.45	2.50	10.94	85.51	175.30	97.57	35.96	9.90	2.44	9.73	....	435.50

NOTE.—S. E. Record.

DISCHARGE OF BOULDER CREEK AT ORODELL FOR 1912

Drainage Area, 108 Square Miles. Altitude, 5,723 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	62	268	....	....	57	32	57	....	
2	....	....	....	....	68	200	....	214	77	51	51	....	
3	....	21	....	....	76	290	....	214	45	45	40	....	
4	....	21	....	21	70	410	....	268	64	51	40	....	
5	....	18	....	21	157	430	....	214	77	70	36	....	
6	....	30	....	23	157	460	....	147	92	70	32	....	
7	....	21	....	20	170	383	....	157	78	77	36	....	
8	....	22	....	22	247	430	....	117	112	57	27	....	
9	....	23	....	25	267	453	371	137	100	84	27	....	
10	....	21	....	28	238	450	394	147	97	40	51	....	
11	....	....	....	20	241	438	....	....	....	70	36	....	
12	....	....	....	34	....	385	....	....	....	57	27	....	
13	....	....	....	19	....	375	603	....	....	....	24	....	
14	....	....	....	14	57	272	630	....	....	....	24	....	
15	....	....	8	16	110	363	684	....	64	....	27	....	
16	....	....	11	10	130	....	630	....	100	....	27	....	
17	....	22	3	11	153	287	495	....	147	....	24	....	
18	....	34	6	11	155	182	394	....	157	....	20	....	
19	....	34	11	8	157	170	371	....	170	....	27	....	
20	....	28	32	10	157	242	268	....	....	20	40	....	
21	....	57	....	10	170	206	268	57	127	20	32	....	
22	....	51	....	10	231	204	418	59	184	27	27	....	
23	....	18	....	11	248	....	443	66	147	40	27	....	
24	....	28	....	21	231	....	394	72	137	32	24	....	
25	....	22	8	26	268	384	394	....	137	36	27	....	
26	....	6	3	15	126	362	371	100	137	40	24	....	
27	....	6	3	26	128	375	371	77	137	32	36	....	
28	....	6	3	40	104	400	328	54	....	45	20	....	
29	....	....	....	45	107	365	468	68	....	45	36	....	
30	....	....	....	50	145	485	820	54	32	40	40	....	
31	....	....	....	....	268	....	....	40	....	45	....	....	
Total	....	489	88	567	4,698	9,269	9,115	2,262	2,475	1,126	966	....	Period
Mean	....	....	....	....	....	....	....	....	....	....	....	....	....
Maximum	....	....	....	....	....	....	....	....	....	....	....	....	....
Minimum	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, depth, inches	....	....	....	....	....	....	....	....	....	....	....	....	....
Run-off, acre-feet	....	970	175	1,125	9,320	18,385	18,080	4,485	4,910	2,235	1,915	....	61,600
Acre-feet per square mile	....	....	....	....	....	....	....	....	....	....	....	....	....

ST. VRAIN CREEK AT LYONS

This station is maintained by the State and is located one-half mile below Lyons and 100 yards below the junction of the North and South Forks of St. Vrain creek.

The equipment consists of a cable of fifty feet span with car and a 4" x 4" slope gauge.

The bed of the stream is composed of medium sized boulders and is permanent. Several ditches take water out above this station. The intakes of the Longmont and Lyons waterworks are also above this station.

The observer is Lloyd Hess, who is paid $3.00 per month.

DISCHARGE MEASUREMENTS OF ST. VRAIN CREEK AT LYONS

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 9	C. E. Turner	6	0.25	1.45	1.5
	Mar. 9	C. E. Turner	16	1.53	1.93	24
	Apr. 12	C. E. Turner	23	1.27	1.98	29
	Apr. 28	C. E. Turner	43	1.57	2.28	68
	May 18	C. E. Turner	88	2.84	3.12	249
	May 26	Thos. Grieve, Jr.	75	3.29	3.15	247
	July 31	C. C. Hezmalhalch	73	2.06	2.70	151
	Aug. 21	C. C. Hezmalhalch	55	1.50	2.43	82
	Sept. 14	Grieve & Hezmalhalch	47	1.49	2.34	70
	Oct. 16	C. E. Turner	46	0.96	2.15	44
	Dec. 15	C. E. Turner	12	0.89	1.77	10
1912	Jan. 18	C. E. Turner	13	1.14	1.82	15
	Mar. 7	C. E. Turner	12	0.75	1.71	9
	Apr. 10	C. E. Turner	52	1.67	2.45	88
	May 15	C. E. Turner	100	3.64	3.45	364
	June 5	D. L. Bundy	116	4.66	3.85	531
	July 6	D. L. Bundy	118	4.59	3.82	541
	Aug. 14	D. L. Bundy	76	2.35	2.85	177
	Sept. 26	D. L. Bundy	55	1.10	2.30	60
	Nov. 23	M. F. Bunger	44	0.89	2.12	39

DISCHARGE OF ST. VRAIN CREEK AT LYONS FOR 1911

Drainage Area, 209 Square Miles. Altitude, 5,349 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	11	8	16	8	28	82	372	302	118	66	82	24	16	
2	12	5	13	16	33	90	372	372	118	66	82	24	16	
3	13	5	13	13	38	108	372	410	160	118	52	28	19	
4	13	5	8	13	33	98	391	410	138	118	52	28	16	
5	11	13	2	16	38	98	410	354	138	98	52	28	19	
6	10	13	2	19	33	160	410	336	138	98	90	28	13	
7	10	13	2	19	28	172	410	354	138	98	90	28	10	
8	11	13	2	16	28	210	450	336	90	90	90	28	8	
9	18	13	4	19	28	210	576	302	82	66	82	28	6	
10	18	13	6	19	38	197	450	238	90	52	66	24	8	
11	16	16	13	19	33	172	430	224	98	45	52	10	6	
12	18	16	10	16	28	172	450	238	108	59	52	13	6	
13	16	16	8	19	24	210	490	224	90	59	52	28	8	
14	10	13	8	13	24	210	450	224	90	66	38	28	6	
15	11	13	8	19	16	238	490	238	82	74	38	28	8	
16	13	10	8	19	33	238	532	224	98	66	38	28	6	
17	18	8	10	13	38	238	490	210	82	59	38	8	5	
18	13	8	5	16	28	224	372	224	90	52	38	13	5	
19	16	8	5	19	33	268	391	238	98	45	38	24	5	
20	16	8	5	19	38	238	410	238	90	28	38	28	5	
21	16	8	6	19	38	210	490	224	90	28	38	8	3	
22	13	10	5	28	52	184	576	224	90	38	38	8	3	
23	13	16	10	19	66	184	490	238	118	38	52	5	5	
24	16	13	10	19	59	210	410	210	128	38	38	3	5	
25	18	10	13	19	66	224	372	184	118	38	33	8	5	
26	13	10	13	16	45	268	354	172	98	33	28	10	5	
27	12	8	13	16	38	268	336	184	82	38	28	13	5	
28	13	10	8	28	59	253	336	172	82	38	24	13	3	
29	12	13	....	19	98	253	336	160	74	59	28	10	5	
30	12	19	....	28	108	285	319	160	74	70	28	16	5	
31	11	19	....	28	....	372	....	138	82	....	28	....	3	
Total	423	353	226	569	1,249	6,344	12,737	7,762	3,172	1,841	1,523	570	238	Year 1911
Mean	14	11	8.1	18	42	205	425	250	102	61	49	19	7.7	100
Maximum	18	19	16	28	108	372	576	410	160	118	90	28	19	576
Minimum	10	5	2	8	16	82	319	138	74	33	24	3	3	2
Run-off per square mile	0.065	0.053	0.039	0.086	0.201	0.981	2.033	1.196	0.488	0.292	0.234	0.091	0.037	0.479
Run-off, depth, inches	0.075	0.061	0.041	0.099	0.224	1.131	2.268	1.379	0.563	0.326	0.270	0.101	0.043	6.501
Run-off, acre-feet	839	700	448	1,129	2,477	12,583	25,263	15,396	6,292	3,652	3,021	1,131	472	72,564
Acre-feet per square mile	4.01	3.35	2.14	5.40	11.85	60.22	120.90	73.67	30.11	17.48	14.45	5.41	2.26	347.30

DISCHARGE OF ST. VRAIN CREEK AT LYONS FOR 1912

Drainage Area, 209 Square Miles. Altitude, 5,349 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	3	13	3	19	138	342	998	470	118	66	28	....	
2	3	13	3	19	160	342	723	382	98	66	38	....	
3	3	8	3	28	160	470	723	306	98	52	38	....	
4	3	8	3	24	138	516	668	270	90	52	28	....	
5	3	8	3	28	149	564	590	238	98	52	28	....	
6	3	8	3	38	160	616	516	224	82	52	28	....	
7	3	8	3	38	184	564	564	197	82	52	28	....	
8	3	8	3	52	184	642	616	184	66	33	28	....	
9	3	8	3	66	184	833	616	184	82	33	28	....	
10	3	5	8	98	210	642	616	160	90	19	38	....	
11	3	3	8	82	254	616	616	160	98	66	45	....	
12	3	3	3	82	342	668	493	160	98	118	45	....	
13	3	3	3	66	448	668	590	160	82	138	38	....	
14	3	3	3	66	540	616	616	160	82	138	28	....	
15	3	3	3	52	564	516	590	172	98	118	28	....	
16	3	3	3	66	642	426	778	172	118	118	28	....	
17	8	3	13	59	590	426	470	160	108	118	28	....	
18	13	3	8	52	564	404	426	138	108	98	28	....	
19	13	3	8	45	516	382	448	138	98	82	28	....	
20	10	3	13	52	540	404	470	128	82	82	24	....	
21	8	3	16	66	564	470	382	118	66	74	19	....	
22	13	13	24	52	516	516	342	108	74	66	19	....	
23	13	13	28	52	448	723	448	118	66	59	19	....	
24	13	13	28	66	382	833	426	98	66	45	19	....	
25	13	3	28	82	362	998	426	98	66	38	19	....	
26	13	3	28	98	426	943	516	98	66	52	19	....	
27	13	3	28	90	426	888	516	118	66	52	19	....	
28	13	3	38	108	238	998	342	118	66	38	19	....	
29	13	3	28	138	224	943	306	138	66	28	19	....	
30	13	....	28	138	270	888	306	138	66	28	19	....	
31	13	....	28	....	426	....	470	118	....	19	....	....	
Total	230	174	402	1,922	10,949	18,857	16,607	5,423	2,544	2,052	820	....	Period
Mean	7	6	13	64	353	629	536	175	85	66	27	....	179
Maximum	13	13	38	138	642	998	998	470	118	138	45	....	998
Minimum	3	3	3	19	138	342	306	98	66	19	19	....	3
Run-off per square mile	0.034	0.029	0.062	0.306	1.689	3.010	2.565	0.837	0.407	0.316	0.130	....	0.856
Run-off, depth, inches	0.039	0.031	0.071	0.342	1.947	3.358	2.957	0.965	0.454	0.364	0.145	....	10.673
Run-off, acre-feet	456	345	797	3,812	21,717	37,403	32,940	10,756	5,046	4,070	1,626	....	118,968
Acre-feet per square mile	2.18	1.65	3.81	18.24	103.90	178.99	157.60	51.46	24.15	19.47	7.78	....	569.23

BIG THOMPSON CREEK AT ARKINS

This station, maintained by the State, is located about ten miles from Loveland and about one-fourth mile below the Handy ditch dam.

The equipment consists of a staff gauge bolted to the down-stream end of middle pier of wagon bridge Measurements are made from the up-stream side of wagon bridge.

The observer at this station was J. F. Waggener, whose salary was $5.00 per month.

This station was discontinued August 31, 1911, owing to inability to obtain an observer.

DISCHARGE MEASUREMENTS OF BIG THOMPSON CREEK AT ARKINS

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 8*	C. E. Turner	37	0.18	0.96	6.5
Mar. 8	C. E. Turner	41	0.73	1.12	30
Apr. 12	Miles & Turner	49	0.73	1.13	36
Apr. 27	Miles & Turner	64	1.02	1.30	65
May 17	Miles & Turner	119	2.68	2.19	319
June 19	Miles & Turner	145	3.58	2.68	519
July 30	C. C. Hezmalhalch	98	1.60	1.80	157
Aug. 20	C. C. Hezmalhalch	87	1.18	1.55	103
Oct. 15	C. E. Turner	40	1.50	1.23	60
Dec. 14	C. E. Turner	32	0.50	1.05	16

*Ice conditions.

DISCHARGE OF BIG THOMPSON CREEK AT ARKINS FOR 1911

Drainage Area, 305 Square Miles. Altitude, 5,260 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	39						500	362	134					
2	48						560	460	124					
3	30						500	540	114					
4	30						540	540	114					
5	12						540	540	114					
6	6						520	477	105					
7	17						560	455	114					
8	30						581	435	105					
9	48						644	453	96					
10	48						560	355	105					
11	48					255	540	315	134					
12	39					222	560	280	124					
13	24					255	623	280	96					
14	30					272	581	313	96					
15	39					325	623	293	96					
16	30					381	623	310	105					
17	30					362	665	290	114					
18	17					362	540	270	105					
19	12					381	560	340	88					
20	24					290	581	305	96					
21	12					238	623	267	114					
22	24					207	644	300	124					
23	30					222	560	338	196					
24	30					255	540	280	170					
25	39					290	500	245	134					
26	24					362	420	210	114					
27	17					344	400	210	96					
28	8					325	420	193	88					
29	5					325	440	160	80					
30	5					381	381	145	80					
31	5					460		145	74					
Total	800					6,514	16,329	10,106	3,449					Period 1911
Mean	26					310	544	326	111					322
Maximum	48					460	644	540	196					644
Minimum	5					207	381	145	74					74
Run-off per square mile	0.085					1.016	1.784	1.069	0.364					1.056
Run-off, depth, inches	0.098					0.793	1.990	1.233	0.419					4.438
Run-off, acre-feet	1,587					12,920	32,388	20,045	6,841					72,195
Acre-feet per square mile	5.20					42.37	106.20	65.72	22.43					236.70

NOTE.—S. E. Record.

CACHE LA POUDRE RIVER AT MOUTH OF CANON

This station is located about twelve miles from Fort Collins at the mouth of the canon and below the headgate of the Poudre Valley canal.

The equipment consists of an automatic gauge, slope gauge and a cable of 115 feet span.

The bed of the stream is composed of sand and boulders and is permanent.

The observer is T. R. McKnight, who is paid $5.00 per month.

The discharge at this station is affected by water carried over the divides from the Grand and Laramie rivers and Michigan creek.

DISCHARGE MEASUREMENTS OF CACHE LA POUDRE AT MOUTH OF CANON

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 7*	C. E. Turner	161	0.28	1.04	44
	Mar. 7	C. E. Turner	34	1.60	0.88	54
	Apr. 11	Miles & Turner	120	0.87	1.12	104
	Apr. 27	Miles & Turner	136	1 15	1.29	138
	May 17	Stearley & Turner	359	3.42	3.02	1,326
	May 27	Thos. Grieve, Jr.	329	3.62	2.92	1,191
	July 28	C. C. Hezmalhalch	239	1.56	1.85	373
	Aug. 18	C. C. Hezmalhalch	193	0.92	1.44	178
	Sept. 15	Grieve & Hezmalhalch	168	0.64	1.20	108
	Oct. 14	C. E. Turner	170	0.60	1.18	103
	Dec. 12	C. E. Turner	28	1.40	1.08	40
1912	Jan. 17*	C. E. Turner	40	1.10	1.65	45
	Mar. 6*	C. E. Turner	30	1.85	1.18	56
	Apr. 6	C. E. Turner	106	0.69	1.06	73
	May 14	C. E. Turner	203	1.13	1.57	23
	June 12	D. L. Bundy	451	5.77	3.98	2,602
	July 23	D. L. Bundy	349	3.64	2.80	1,270
	Aug. 12	D. L. Bundy	242	1.57	1.85	381
	Sept. 25	D. L. Bundy	195	1.09	1.45	213
	Nov. 22	M. E. Bunger	123	0.40	0.88	50

*Ice conditions.

DISCHARGE OF CACHE LA POUDRE AT MOUTH OF CANON FOR 1911

Drainage Area, 1,060 Square Miles. Altitude, 5,070 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	60	45	45	35	35	198	1,625	1,860	255	278	215	70	70	
2	60	45	45	35	35	198	1,860	1,860	300	400	215	70	70	
3	60	45	45	35	50	198	1,800	1,568	198	400	162	62	60	
4	60	45	45	35	70	235	1,740	1,740	198	375	145	62	60	
5	60	45	45	35	62	278	1,800	1,455	198	325	145	55	60	
6	60	45	45	35	50	490	1,800	1,290	235	198	215	55	50	
7	60	45	45	40	50	520	1,740	1,400	162	215	235	45	50	
8	60	55	45	62	45	660	1,985	1,240	198	235	180	55	50	
9	60	55	45	35	45	555	2,235	810	198	235	180	62	50	
10	60	55	45	35	62	855	2,048	730	180	162	162	80	45	
11	60	55	45	32	62	695	1,740	695	180	130	130	75	45	
12	60	55	45	35	45	660	1,740	660	215	130	130	70	40	
13	60	55	45	32	40	730	1,740	625	235	145	115	62	40	
14	60	55	45	30	45	900	1,625	695	198	115	115	80	40	
15	60	55	45	30	50	990	1,740	660	198	130	102	90	40	
16	45	50	45	40	50	1,140	1,985	660	180	130	102	90	40	
17	45	50	45	45	50	1,190	2,235	660	180	130	90	90	40	
18	45	50	45	50	55	1,190	1,740	555	198	102	102	90	40	
19	45	50	45	35	50	1,240	1,568	460	198	102	102	90	40	
20	45	50	40	40	50	945	1,568	555	180	102	102	62	40	
21	45	45	40	45	55	855	1,568	520	180	102	102	62	40	
22	45	45	40	45	62	810	1,510	660	215	102	70	55	40	
23	45	45	40	50	70	810	1,510	430	300	102	102	55	40	
24	45	45	40	45	115	900	1,455	162	300	130	102	55	40	
25	45	45	40	35	115	900	1,190	102	300	115	90	62	40	
26	45	45	40	35	115	1,290	1,090	235	255	115	80	50	40	
27	45	45	40	45	115	1,090	1,290	162	215	102	80	50	40	
28	45	45	40	45	115	1,040	1,625	255	215	102	80	50	40	
29	45	45	....	50	115	1,190	1,800	375	215	130	80	50	40	
30	45	45	....	50	198	1,240	1,860	325	235	162	80	50	40	
31	45	45	....	45	....	1,400	....	278	235	....	80	....	40	
Total	1,470	1,500	1,215	1,241	2,076	25,392	51,212	23,682	6,769	5,201	3,890	1,954	1,410	Year 1911
Mean	47	48	43	40	69	819	1,707	764	218	173	126	65	46	344
Maximum	60	55	45	62	198	1,400	2,235	1,860	300	400	235	90	70	2,235
Minimum	45	45	40	30	35	198	1,090	102	162	102	70	45	40	30
Run-off per square mile	0.044	0.045	0.040	0.038	0.065	0.773	1.610	0.721	0.206	0.163	0.119	0.061	0.043	0.325
Run-off, depth, inches	0.051	0.052	0.042	0.044	0.072	0.891	1.796	0.831	0.238	0.182	0.138	0.068	0.049	4.409
Run-off, acre-feet	2,916	2,975	2,410	2,462	4,118	50,363	101,578	46,973	13,426	10,316	7,716	3,876	2,797	249,010
Acre-feet per square mile	2.75	2.81	2.27	2.32	3.88	47.52	95.84	44.32	12.67	9.74	7.28	3.66	2.64	234.91

NOTE.—Ice conditions Dec. 1, 1910-Mar. 5, 1911, Nov. 10-Dec. 31. Discharge estimated from measurements.

DISCHARGE OF CACHE LA POUDRE RIVER MOUTH OF CANON FOR 1912

Drainage Area, 1,060 Square Miles. Altitude, 5,070 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	40	50	55	50	460	1,855	1,790	990	278	162	32	....	
2	40	50	55	45	460	1,920	1,598	900	255	180	30	....	
3	40	50	55	50	300	2,270	1,598	810	215	255	28	....	
4	40	50	55	55	255	2,555	1,535	695	215	278	35	....	
5	40	50	55	70	215	2,480	1,475	590	215	255	32	....	
6	40	50	55	80	215	2,555	1,358	555	235	198	30	....	
7	40	50	60	102	250	2,555	1,358	555	235	215	32	....	
8	40	50	65	95	290	2,480	1,475	490	198	255	32	....	
9	40	50	70	95	325	2,480	1,475	490	235	235	30	....	
10	40	50	75	90	350	2,410	1,415	430	278	255	30	....	
11	45	50	75	75	325	2,340	1,415	400	235	278	50	....	
12	45	50	75	60	300	2,410	1,300	375	215	300	45	....	
13	45	50	80	50	278	2,630	1,300	400	215	255	35	....	
14	45	50	90	40	235	2,780	1,358	375	235	235	45	....	
15	45	50	90	32	300	2,340	1,245	430	180	215	45	....	
16	45	55	90	35	490	2,130	1,090	400	198	235	32	....	
17	45	55	90	30	555	1,790	1,040	375	215	215	26	....	
18	45	55	102	30	695	1,358	990	325	255	162	45	....	
19	45	55	90	30	770	1,140	1,040	278	235	180	55	....	
20	45	55	90	55	810	1,190	1,090	300	255	180	55	....	
21	45	55	80	35	1,090	1,475	990	278	235	102	55	....	
22	45	55	75	30	1,245	1,535	900	278	162	70	55	....	
23	45	55	70	55	1,190	1,990	990	375	162	55	45	....	
24	45	55	45	55	1,140	2,200	945	350	180	30	40	....	
25	45	55	45	70	1,535	2,270	990	325	180	32	70	....	
26	45	55	45	55	1,725	2,340	1,040	278	162	35	80	....	
27	45	55	45	55	1,598	2,940	1,358	235	180	45	80	....	
28	45	55	55	70	1,245	2,410	1,190	235	180	55	80	....	
29	45	55	55	70	1,415	2,270	990	235	162	32	80	....	
30	45	....	55	215	1,920	2,480	900	255	145	30	80	....	
31	45	....	62	....	2,340	....	900	300	....	30	....	....	
Total	1,345	1,520	2,104	1,879	24,321	65,578	38,138	13,307	6,345	5,059	1,409	....	Period
Mean	43	52	68	63	785	2,186	1,230	429	212	163	47	....	481
Maximum	45	55	102	215	2,340	2,940	1,790	990	278	300	80	....	2,940
Minimum	40	50	45	30	215	1,140	900	235	145	30	26	....	26
Run-off per square mile	0.041	0.049	0.064	0.059	0.741	2.062	1.160	0.405	0.200	0.154	0.044	....	0.453
Run-off, depth, inches	0.047	0.053	0.074	0.066	0.854	2.300	1.337	0.470	0.223	0.177	0.049	....	5.650
Run-off, acre-feet	2,668	3,015	4,173	3,727	48,241	130,074	75,646	26,394	12,585	10,035	2,795	....	319,353
Acre-feet per square mile	2.52	2.84	3.94	3.52	45.51	122.71	71.36	24.90	11.87	9.47	2.64	....	301.28

NOTE.—Ice conditions Jan. 1-Mar. 16. Discharge estimated from measurements.

LARAMIE RIVER AT GLENDEVEY

This station is maintained in co-operation with the United States Forest Service. It is located about one-eighth mile from Glendevey on road between Fort Collins and Walden.

The equipment consists of a staff gauge and automatic gauge.

The observer is the United States Forest ranger whose services are gratis.

The drainage area above this station, as published in previous years, was found to be considerably in error and is published here as corrected.

DISCHARGE MEASUREMENTS OF LARAMIE RIVER AT GLENDEVEY

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	May 14	C. E. Turner	78	3.68	2.90	288
	July 8	C. E. Turner	77	3.00	2.78	232
	July 18	C. E. Turner	40	2.19	2.30	88
	July 23	C. E. Turner	46	2.11	2.35	96
	Aug. 18	C. E. Turner	33	1.09	2.00	36
	Aug. 20	C. E. Turner	31	1.34	2.04	41
	Sept. 17	C. E. Turner	26	0.90	1.84	23
	Oct. 7	C. E. Turner	34	1.55	2.12	53
	Oct. 18	C. C. Hezmalhalch	39	0.78	1.95	30
1912	May 11	C. E. Turner	40	1.80	2.25	72
	June 16	M. E. Bunger	96	3.54	3.20	340
	July 14	M. E. Bunger	103	4.07	3.40	426
	July 20	M. E. Bunger	88	3.31	3.00	291
	July 24	M. E. Bunger	68	2.50	2.70	170
	Aug. 16	M. E. Bunger	47	1.47	2.25	69
	Sept. 27	M. E. Bunger	40	0.99	2.05	39

DISCHARGE OF LARAMIE RIVER AT GLENDEVEY FOR 1911

Drainage Area, 102 Square Miles.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	16	10	19	22	84	461	166	49	26	84	14	....	
2	....	19	10	19	26	74	517	264	49	26	57	16	....	
3	....	26	14	14	31	74	461	264	49	26	49	16	....	
4	....	22	19	16	31	84	461	285	49	31	42	19	....	
5	....	16	19	19	26	135	488	264	49	26	57	19	....	
6	....	22	16	19	26	135	488	264	42	31	84	16	....	
7	....	19	14	19	16	184	576	264	42	26	74	22	....	
8	....	14	10	19	19	264	517	201	36	26	65	22	....	
9	....	12	12	19	26	332	705	201	36	26	49	22	....	
10	....	12	16	19	26	285	461	122	36	22	42	26	....	
11	....	10	19	19	26	184	434	84	42	19	31	26	....	
12	....	14	16	19	22	201	434	74	42	19	26	26	....	
13	....	19	10	36	16	242	434	96	36	19	26	26	....	
14	....	14	8	31	12	264	461	150	36	22	26	22	....	
15	....	14	8	31	14	357	546	108	31	26	14	22	....	
16	....	14	9	19	22	408	606	96	31	22	22	26	....	
17	....	14	16	16	36	408	606	96	36	22	31	22	....	
18	....	16	22	19	31	382	488	84	36	19	26	22	....	
19	....	16	14	19	42	264	434	122	42	22	26	22	....	
20	....	14	10	19	36	166	546	96	36	22	26	19	....	
21	....	14	10	19	49	135	812	84	42	22	26	19	....	
22	....	14	10	19	65	166	740	74	36	26	26	16	....	
23	....	16	10	14	49	184	740	96	57	57	26	19	....	
24	....	16	12	19	49	264	670	84	42	31	26	16	....	
25	....	16	14	22	74	285	434	74	36	26	19	19	....	
26	....	16	12	26	84	264	285	74	31	22	16	19	....	
27	....	19	10	19	84	332	285	74	26	26	19	14	....	
28	....	22	10	19	74	332	222	74	26	31	19	15	....	
29	....	19	....	26	65	357	201	65	26	31	19	15	....	
30	....	16	....	22	65	357	184	57	22	42	16	15	....	
31	....	12	....	14	....	408	....	49	22	....	16	....	....	
Total	....	503	360	629	1,164	7,611	14,697	4,106	1,171	792	1,085	592	....	Period
Mean	....	16	13	20	39	246	490	132	38	26	35	20	....	98
Maximum	....	26	22	36	84	408	812	285	57	57	84	26	....	812
Minimum	....	10	8	14	12	74	184	49	22	19	14	14	....	8
Run-off per square mile	....	0.159	0.126	0.199	0.380	2.412	4.804	1.294	0.371	0.259	0.343	0.193	....	0.961
Run-off, depth, inches	....	0.183	0.131	0.230	0.424	2.780	5.360	1.492	0.428	0.289	0.396	0.215	....	11.937
Run-off, acre-feet	....	998	714	1,248	2,309	15,096	29,151	8,144	2,323	1,571	2,152	1,174	....	64,879
Acre-feet per square mile	....	9.78	7.00	12.24	22.64	148.00	285.78	79.84	22.77	15.40	21.10	11.51	....	636.07

DISCHARGE OF LARAMIE RIVER AT GLENDEVEY FOR 1912

Drainage Area, 102 Square Miles.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	26	16	19	12	36	524	568	142	40	46	25	....	
2	26	19	19	10	49	568	460	117	30	40	30	....	
3	19	19	16	10	49	727	420	106	25	40	34	....	
4	14	14	16	12	42	798	380	76	34	60	30	....	
5	26	16	16	14	36	798	400	60	30	60	25	....	
6	26	16	16	12	36	774	361	60	30	40	25	....	
7	42	16	19	10	42	774	342	53	34	34	25	....	
8	26	14	16	12	57	774	250	60	30	40	19	....	
9	22	14	16	16	74	750	250	60	25	40	30	....	
10	16	16	16	26	49	704	232	68	25	40	34	....	
11	14	16	16	31	57	612	232	53	25	34	30	....	
12	14	14	16	36	50	568	268	46	25	30	19	....	
13	12	16	14	31	38	568	342	40	25	25	22	....	
14	10	16	16	22	49	546	400	30	22	25	25	....	
15	12	16	22	19	56	460	274	34	25	25	25	....	
16	19	16	16	19	89	380	240	46	40	30	19	....	
17	19	14	14	16	122	323	228	46	46	34	19	....	
18	16	14	14	14	146	304	214	46	53	40	25	....	
19	16	16	19	16	190	286	234	40	60	46	40	....	
20	14	16	16	16	272	286	292	40	60	46	25	....	
21	12	16	26	14	308	286	230	40	46	46	22	....	
22	14	14	42	12	347	323	194	30	46	40	22	....	
23	16	19	26	12	406	400	206	34	53	40	25	....	
24	19	16	16	22	424	482	185	34	34	40	25	....	
25	22	16	19	26	464	503	156	30	34	34	22	....	
26	26	16	16	22	508	482	170	30	40	34	19	....	
27	31	16	14	26	424	568	156	30	46	34	19	....	
28	22	14	16	36	382	568	142	46	46	30	20	....	
29	19	16	22	42	444	568	117	53	40	30	20	....	
30	19	....	19	36	548	568	170	53	40	30	20	....	
31	16	....	16	....	568	....	142	60	....	25	....	....	
Total	605	457	564	602	6,362	16,272	8,255	1,663	1,109	1,158	740	....	Period
Mean	20	16	18	20	205	542	266	54	37	37	25	....	113
Maximum	42	19	42	42	568	798	568	142	60	60	40	....	798
Minimum	10	14	14	10	36	286	117	30	22	25	19	....	10
Run-off per square mile	0.196	0.157	0.176	0.196	2.010	5.314	2.608	0.529	0.363	0.363	0.245	....	1.106
Run-off, depth, inches	0.226	0.170	0.203	0.219	2.317	5.929	3.007	0.610	0.405	0.419	0.273	....	13.779
Run-off, acre-feet	1,200	906	1,119	1,194	12,619	32,276	16,374	3,298	2,200	2,297	1,468	....	74,950
Acre-feet per square mile	11.76	8.88	10.97	11.75	123.70	316.40	160.55	32.33	21.57	22.52	14.39	....	734.80

LARAMIE RIVER AT BOSWELL'S RANCH NEAR JELM, WYOMING

This station, established August 20, 1910, is located at highway bridge at Boswell's ranch near the Colorado-Wyoming line.

The equipment consists of a vertical staff gauge and automatic gauge. The automatic gauge was installed July 14, 1911.

The bed of the stream is composed of gravel and boulders and is fairly permanent.

The observer is Mrs. C. D. Oviatt, whose salary is $5.00 per month.

The drainage area above this station, as published in previous years, was found to be in error and is published here as corrected.

DISCHARGE MEASUREMENTS OF LARAMIE RIVER NEAR JELM, WYOMING

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 May 7	R. H. Fletcher	158	2.41	2.15	382
May 15	C. E. Turner	187	3.62	2.60	677
June 6	R. H. Fletcher	218	4.87	3.60	1,060
June 15	R. H. Fletcher	199	4.47	2.80	890
June 24	R. H. Fletcher	170	3.27	2.35	556
July 10	C. E. Turner	136	1.65	1.75	225
July 14	C. E. Turner	143	2.16	1.99	309
July 14	C. E. Turner	136	1.87	1.83	254
July 15	R. H. Fletcher	128	1.53	1.60	197
July 20	C. E. Turner	79	2.32	1.60	182
Aug. 19	C. E. Turner	48	1.37	1.14	65
Aug. 22	C. E. Turner	50	1.49	1.19	75
Sept. 19	B. S. Clayton	39	1.17	1.00	45
Oct. 8	C. E. Turner	57	1.64	1.31	93
1912 May 11	C. E. Turner	68	2.16	1.48	147
June 17	M. E. Bunger	193	4.36	2.78	841
July 18	M. E. Bunger	157	2.58	2.20	405
July 25	Robt. Follansbee	140	2.14	1.88	299
Aug. 13	M. E. Bunger	46	2.40	1.40	110
Aug. 16	M. E. Bunger	72	2.08	1.50	150
Sept. 26	M. E. Bunger	54	1.70	1.28	92

DISCHARGE OF LARAMIE RIVER AT BOSWELL'S RANCH NEAR JELM, WYO., FOR 1911

Drainage Area, 365 Square Miles.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	....	....	877	278	94	43	94	50	....	
2	....	....	....	....	....	....	965	492	94	43	94	50	....	
3	....	....	....	....	....	....	970	488	94	43	65	65	....	
4	....	....	....	....	....	....	972	378	94	50	56	74	....	
5	....	....	....	....	....	....	1,023	428	94	50	74	74	....	
6	....	....	....	....	....	....	978	423	84	43	132	94	....	
7	....	....	....	....	....	387	933	348	74	43	106	94	....	
8	....	....	....	....	....	497	1,023	323	74	43	84	84	....	
9	....	....	....	....	....	592	1,210	260	65	43	74	74	....	
10	....	....	....	....	....	665	888	207	74	43	74	74	....	
11	....	....	....	....	....	412	845	118	84	38	74	50	....	
12	....	....	....	....	....	412	845	145	94	38	65	56	....	
13	....	....	....	....	....	527	803	160	74	38	56	56	....	
14	....	....	....	....	....	628	803	260	56	38	56	60	....	
15	....	....	....	....	....	706	803	198	43	43	65	60	....	
16	....	....	....	....	....	745	1,070	194	56	43	56	60	....	
17	....	....	....	....	....	790	1,070	205	74	43	65	60	....	
18	....	....	....	....	....	833	765	184	74	43	65	60	....	
19	....	....	....	....	....	760	690	165	65	38	56	60	....	
20	....	....	....	....	....	610	933	175	65	38	56	60	....	
21	....	....	....	....	....	485	933	160	74	43	65	60	....	
22	....	....	....	....	....	458	846	175	74	43	65	55	....	
23	....	....	....	....	....	460	653	160	106	65	56	55	....	
24	....	....	....	....	....	590	583	145	74	74	56	55	....	
25	....	....	....	....	....	705	515	132	65	43	56	55	....	
26	....	....	....	....	....	820	425	132	65	38	56	55	....	
27	....	....	....	....	....	670	370	118	50	33	65	55	....	
28	....	....	....	....	....	673	345	118	43	33	56	55	....	
29	....	....	....	....	....	712	323	118	50	33	56	55	....	
30	....	....	....	....	....	753	300	106	43	43	56	55	....	
31	....	....	....	....	....	833	....	106	43	....	56	....	....	
Total	....	....	....	....	....	15,717	23,759	6,899	2,213	1,292	2,110	1,870	....	Period 1911
Mean	....	....	....	....	....	629	792	223	71	43	68	62	....	259
Maximum	....	....	....	....	....	833	1,210	492	106	74	132	94	....	1,210
Minimum	....	....	....	....	....	387	300	106	43	33	56	50	....	43
Run-off per square mile	....	....	....	....	....	1.723	2.170	0.611	0.195	0.118	0.186	0.170	....	0.710
Run-off, depth, inches	....	....	....	....	....	1.602	2.421	0.704	0.225	0.132	0.215	0.190	....	5.492
Run-off, acre-feet	....	....	....	....	....	31,174	47,125	13,684	4,389	2,563	4,185	3,709	....	106,830
Acre-feet per square mile	....	....	....	....	....	85.41	129.11	37.49	12.02	7.02	11.47	10.16	....	292.68

NOTE.—Discharge estimated Nov. 15-30.

DISCHARGE OF LARAMIE RIVER AT BOSWELL'S RANCH NEAR JELM, WYO., FOR 1912

Drainage Area, 365 Square Miles.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	109	1,390	1,250	290	86	86	76	....	
2	....	....	....	....	122	1,435	1,018	217	76	86	76	....	
3	....	....	....	....	134	1,578	875	198	76	97	66	....	
4	....	....	....	....	109	1,670	828	180	66	110	66	....	
5	....	....	....	....	97	1,670	923	150	57	110	66	....	
6	....	....	....	....	76	1,670	735	150	66	97	66	....	
7	....	....	....	....	97	1,625	605	132	57	97	66	....	
8	....	....	....	....	134	1,578	530	190	57	97	50	....	
9	....	....	....	....	162	1,578	568	158	57	86	66	....	
10	....	....	....	....	162	1,578	530	128	66	97	76	....	
11	....	....	....	....	162	1,483	530	115	76	86	57	....	
12	....	....	....	134	177	1,390	648	100	66	76	43	....	
13	....	....	....	109	193	1,390	690	100	66	66	43	....	
14	....	....	....	76	210	1,345	735	92	76	66	57	....	
15	....	....	....	57	226	1,155	605	105	86	66	57	....	
16	....	....	....	50	261	970	530	134	97	76	57	....	
17	....	....	....	57	318	828	465	122	97	86	38	....	
18	....	....	....	67	362	735	438	109	97	86	50	....	
19	....	....	....	86	465	690	417	97	110	97	66	....	
20	....	....	....	76	568	690	477	97	134	86	66	....	
21	....	....	....	57	605	735	410	86	97	57	43	....	
22	....	....	....	43	690	828	360	76	86	66	50	....	
23	....	....	....	38	780	970	340	86	97	76	50	....	
24	....	....	....	67	875	1,110	345	76	86	66	50	....	
25	....	....	....	67	970	1,155	307	76	76	76	50	....	
26	....	....	....	67	1,155	1,110	300	67	86	86	50	....	
27	....	....	....	67	1,065	1,250	320	57	97	97	38	....	
28	....	....	....	67	875	1,298	280	67	86	76	40	....	
29	....	....	....	86	1,018	1,250	242	76	86	76	40	....	
30	....	....	....	97	1,435	1,203	240	86	86	76	40	....	
31	....	....	....	....	1,530	....	292	97	....	76	....	....	
Total	....	....	....	1,368	15,142	37,357	16,833	3,714	2,452	2,582	1,659	....	Period
Mean	....	....	....	72	488	1,245	543	120	82	83	55	....	348
Maximum	....	....	....	134	1,530	1,670	1,250	290	134	110	76	....	1,670
Minimum	....	....	....	38	76	690	240	57	57	57	38	....	38
Run-off per square mile	....	....	....	0.197	1.337	3.411	1.488	0.329	0.225	0.227	0.151	....	0.954
Run-off, depth, inches	....	....	....	0.139	1.541	3.806	1.716	0.379	0.251	0.262	0.168	....	8.262
Run-off acre-feet	....	....	....	2,713	30,034	74,097	33,388	7,367	4,863	5,121	3,290	....	160,873
Acre-feet per square mile	....	....	....	7.43	82.28	203.01	91.47	20.18	13.32	14.03	9.01	....	440.73

Rio Grande Drainage

RIO GRANDE AT THIRTY-MILE BRIDGE NEAR CREEDE

This station is located at the thirty-mile bridge, thirty miles west of Creede and just below the dam site of the Farmers' Union reservoir.

The equipment consists of a chain gauge and cable with car.

The bed of the stream is rough but permanent.

Gauge heights and measurements were furnished by the Farmers' Union Irrigation Company. A few measurements were also made by State hydrographers.

The equipment at this station was lost in the high water of October, 1911.

DISCHARGE MEASUREMENTS OF RIO GRANDE AT THIRTY-MILE BRIDGE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Apr. 23	O. P. Pennock	103	2.30	3.23	237
May 3	O. P. Pennock	115	2.22	3.38	255
May 5	O. P. Pennock	162	2.85	4.16	462
May 6	O. P. Pennock	183	3.16	4.47	577
May 8	O. P. Pennock	210	3.25	4.81	681
May 10	O. P. Pennock	198	3.07	4.68	609
May 20	O. P. Pennock	196	2.90	4.54	571
May 24	O. P. Pennock	235	3.89	5.35	914
May 26	O. P. Pennock	229	3.61	5.19	827
May 31	O. P. Pennock	238	4.02	5.49	958
June 1	B. S. Clayton	238	4.12	5.68	981
June 3	O. P. Pennock	249	4.50	5.88	1,123
June 4	O. P. Pennock	267	4.69	6.18	1,255
June 6	O. P. Pennock	285	5.20	6.45	1,481
June 8	O. P. Pennock	324	5.79	7.14	1,877
July 25	B. S. Clayton	184	2.99	4.62	551
July 26	B. S. Clayton	180	2.82	4.49	507
Aug. 9	O. M. Wimmer	130	1.40	3.32	182

DISCHARGE OF RIO GRANDE AT THIRTY-MILE BRIDGE FOR 1911

Drainage Area, 163 Square Miles. Altitude, 9,500 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						213	1,140	880	313	105	697			
2						235	1,160	1,210	287	105	605			
3						246	1,190	1,260	287	113	471			
4						344	1,350	1,080	251	113	353			
5						458	1,560	930	228	105				
6						537	1,620	880	217	98				
7						571	1,620	880	206	92				
8						641	1,880	790	185	86				
9						715	1,950	678	175	86				
10						659	1,700	641	206	86				
11						554	1,700	587	185	81				
12						588	1,560	570	165	86				
13						605	1,360	1,210	165	155				
14						505	1,300	980	155	121				
15						505	1,240	830	165	121				
16						521	1,300	717	195	113				
17						623	1,180	623	165	98				
18						753	1,180	623	155	92				
19						773	1,360	735	146	105				
20						588	1,240	678	137	98				
21						571	1,410	659	155	86				
22					203	677	1,300	605	287	86				
23					213	835	1,240	605	217	185				
24					203	973	1,140	553	165	105				
25					193	949	980	553	146	92				
26					246	879	930	503	137	206				
27					269	773	980	455	146	195				
28					305	857	980	455	137	175				
29					281	902	880	395	129	206				
30					235	973	1,030	367	113	455				
31						1,050		339	105					
Total					2,148	20,073	39,460	22,271	5,725	3,850	2,126			Period 1911
Mean					239	648	1,315	718	185	128	532			576
Maximum					305	1,050	1,950	1,260	313	455	697			1,950
Minimum					193	213	880	339	105	81	353			81
Run-off per square mile					1.466	3.975	8.067	4.405	1.135	0.785	3.264			3.534
Run-off, depth, inches					0.491	4.583	9.001	5.078	1.308	0.876	0.486			21.823
Run-off, acre-feet					4,260	39,814	78,268	44,174	11,355	7,636	4,217			189,724
Acre-feet per square mile					26.14	244.26	480.20	271.01	69.66	46.84	25.87			1,163.98

RIO GRANDE NEAR CREEDE

This station is maintained in co-operation with the United States Forest Service and is located at Wason on the Creede branch of the Denver & Rio Grande railroad.

The equipment consists of an automatic gauge and chain gauge located on wagon bridge just below Wason.

The bed of the stream is composed of small and medium sized boulders and is fairly permanent.

The gauges have been taken care of by the United States Forest ranger free of charge.

DISCHARGE MEASUREMENTS OF RIO GRANDE NEAR CREEDE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 19*	G. H. Russell	94	1.81	0.44	170
Feb. 25*	Clayton & Turner	102	1.53	0.16	156
Mar. 28	B. S. Clayton	115	1.90	0.42	219
Apr. 28	B. S. Clayton	291	3.38	1.74	982
May 31	B. S. Clayton	510	5.02	3.45	2,560
June 2	B. S. Clayton	554	5.84	3.82	3,230
June 27	O. M. Wimmer	419	4.80	2.90	2,010
July 27	B. S. Clayton	....	....	2.40	1,420
Sept. 8	B. S. Clayton	197	2.18	0.92	431
Aug. 11	O. M. Wimmer	234	2.44	1.43	571
Oct. 2	H. B. Waha	463	3.97	2.60	1,840
Oct. 12	B. S. Clayton	330	4.00	2.17	1,320
Dec. 20	B. S. Clayton	133	1.64	0.58	220
1912 Jan. 19*	B. S. Clayton	121	1.58	1.46	191
Feb. 24*	B. S. Clayton	85	1.62	0.64	138
Apr. 2	B. S. Clayton	88	1.36	0.05	120
May 11	B. S. Clayton	290	2.96	1.58	858
June 4	O. C. Hesmalhalch	653	7.55	4.69	4,932
July 10	C. C. Hezmalhalch	351	3.50	2.08	1,228
Aug. 21	C. C. Hezmalhalch	260	2.52	1.35	654
Sept. 12	C. E. Turner	210	1.73	0.85	363
Nov. 14	C. E. Turner	89	1.42	0.11	126

* Ice conditions.

DISCHARGE OF RIO GRANDE NEAR CREEDE FOR 1911

Drainage Area, 700 Square Miles. Altitude, 8,590 Feet Above Sea Level.

DAY	Dec 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	125	150	120	370	728	2,880	2,560	1,120	542	1,380	515	300	
2	....	125	150	120	392	728	3,010	3,070	1,050	542	1,380	515	300	
3	....	125	150	132	392	760	2,940	2,740	1,010	542	1,250	490	300	
4	....	125	150	120	392	938	3,270	2,810	975	542	1,010	465	300	
5	....	125	150	120	348	1,290	3,620	2,310	900	542	4,230	490	300	
6	....	125	150	108	348	1,580	3,890	2,070	830	515	5,170	490	300	
7	....	125	130	120	325	1,630	3,770	2,240	795	465	3,270	465	300	
8	....	125	130	120	348	1,900	3,770	2,070	760	465	2,430	515	250	
9	....	125	120	120	325	2,180	4,310	1,790	728	415	1,840	490	250	
10	....	150	145	132	348	2,240	4,070	1,630	728	392	1,580	490	250	
11	....	150	145	160	325	1,840	3,840	1,480	760	392	1,430	440	250	
12	....	150	145	145	348	1,790	3,700	1,430	728	392	1,290	440	250	
13	....	170	130	132	325	1,790	3,340	2,070	728	392	1,160	440	250	
14	....	170	145	120	325	1,430	3,270	2,740	695	465	1,090	465	250	
15	....	170	130	120	305	1,380	3,010	2,370	695	440	1,010	415	220	
16	....	170	150	132	348	1,380	3,070	2,120	728	515	900	440	220	
17	....	170	150	145	415	1,520	3,010	1,580	695	440	865	440	220	
18	....	170	170	132	370	1,790	2,880	1,630	695	392	795	415	220	
19	....	170	150	132	415	2,070	2,940	1,520	662	392	728	400	220	
20	....	170	150	145	490	1,790	3,140	1,520	630	440	695	400	220	
21	....	170	150	175	542	1,740	2,880	1,520	630	392	695	400	220	
22	....	170	160	192	600	1,740	3,070	1,480	1,050	370	695	350	200	
23	....	170	160	160	630	2,070	2,680	1,480	975	440	662	350	200	
24	....	170	160	160	600	2,430	2,500	1,480	830	415	630	300	200	
25	....	150	156	192	600	2,500	2,240	1,480	760	392	662	300	170	
26	....	150	130	175	695	2,620	2,070	1,480	695	490	630	300	170	
27	....	150	130	160	865	2,180	2,010	1,480	695	570	630	300	170	
28	....	150	130	192	900	2,180	2,120	1,480	695	515	600	300	170	
29	....	150	....	228	975	2,240	2,070	1,380	630	515	570	300	170	
30	....	150	....	265	975	2,310	2,370	1,290	570	900	542	300	170	
31	....	150	....	325	....	2,620	....	1,200	542	....	542	....	170	
Total	....	4,665	4,066	4,799	14,636	55,384	91,690	57,500	23,984	14,221	40,361	12,420	7,180	Year 1911
Mean	....	150	145	155	488	1,787	3,056	1,855	774	474	1,302	414	232	907
Maximum	....	170	170	325	975	2,620	4,310	3,070	1,120	900	5,170	515	300	5,170
Minimum	....	125	120	108	305	728	2,010	1,200	542	370	542	300	170	108
Run-off per square mile	....	0.214	0.207	0.221	0.697	2.553	4.366	2.650	1.106	0.677	1.860	0.591	0.331	1.295
Run-off, depth, inches	....	0.247	0.216	0.255	0.778	2.943	4.871	3.055	1.275	0.755	2.144	0.659	0.382	17.580
Run-off, acre-feet	....	9,253	8,065	9,519	29,030	109,856	181,865	114,050	47,572	28,207	80,055	24,635	14,241	656,348
Acre-feet per square mile	....	13.22	11.52	13.60	41.47	156.94	259.81	162.93	67.96	40.30	114.36	35.19	20.34	937.64

NOTE.—Discharge estimated Jan. 1-Feb. 24, Nov. 19-Dec. 31.

DISCHARGE OF RIO GRANDE NEAR CREEDE FOR 1912

Drainage Area, 700 Square Miles. Altitude, 8,590 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	170	180	165	120	950	4,290	2,530	1,180	460	240	240	....	
2	170	180	150	130	1,035	4,532	2,370	1,080	410	240	225	....	
3	170	180	150	180	950	4,865	2,210	950	385	240	225	....	
4	170	180	140	210	620	5,290	2,050	870	385	240	210	....	
5	170	175	130	225	655	5,205	1,880	795	360	280	210	....	
6	175	175	195	240	620	4,698	1,720	760	360	260	195	....	
7	175	175	210	280	830	4,532	1,560	725	340	360	180	....	
8	175	175	195	360	1,230	4,290	1,400	690	320	410	165	....	
9	175	175	195	435	1,230	4,130	1,300	655	320	360	150	....	
10	175	170	260	510	950	3,810	1,230	620	340	320	150	....	
11	175	170	210	485	990	3,650	1,130	590	340	280	140	....	
12	180	170	140	410	1,330	3,125	1,130	620	360	280	140	....	
13	180	170	140	320	1,380	2,675	1,130	655	360	280	140	....	
14	180	165	140	280	1,180	2,600	1,130	795	360	280	130	....	
15	180	165	150	300	910	2,825	1,130	950	320	280	130	....	
16	185	165	150	320	1,130	2,975	1,080	870	320	280	130	....	
17	185	160	150	340	1,690	2,675	1,035	830	300	260	130	....	
18	185	160	160	280	2,530	2,115	950	910	280	280	130	....	
19	190	160	160	260	3,275	1,990	990	760	280	280	130	....	
20	190	150	165	225	3,575	2,115	1,080	760	280	280	130	....	
21	190	150	165	195	3,970	2,460	950	690	280	260	130	....	
22	190	145	165	180	4,050	2,530	1,035	535	260	260	130	....	
23	190	145	165	240	3,890	2,750	1,230	485	240	260	130	....	
24	190	140	165	385	4,130	2,750	1,280	460	240	260	130	....	
25	190	140	165	510	4,532	2,675	1,180	435	240	260	130	....	
26	185	145	165	410	4,532	2,530	1,180	435	240	280	130	....	
27	185	150	165	410	4,370	2,390	1,280	435	240	260	130	....	
28	185	150	140	435	4,615	2,390	1,180	460	240	435	130	....	
29	185	150	150	655	4,950	2,600	1,330	460	225	320	130	....	
30	185	....	150	870	5,120	2,675	1,530	435	225	860	130	....	
31	185	....	140	....	4,698	....	1,380	435	....	280	....	....	
Total	5,615	4,715	5,090	10,200	75,917	98,137	42,590	21,230	9,310	8,985	4,580	....	Period
Mean	181	163	164	340	2,449	3,271	1,374	685	310	290	153	....	855
Maximum	190	180	210	870	5,120	5,290	2,530	1,180	460	435	240	....	5,290
Minimum	170	145	130	120	620	1,990	950	435	225	240	130	....	120
Run-off per square mile	0.259	0.233	0.234	0.486	3.498	4.673	1.963	0.980	0.443	0.414	0.219	....	1.221
Run-off, depth, inches	0.299	0.251	0.270	0.543	4.033	5.213	2.263	1.130	0.494	0.477	0.244	....	15.212
Run-off, acre-feet	11,137	9,352	10,095	20,232	150,581	194,654	84,477	42,110	18,466	17,821	9,085	....	568,005
Acre-feet per square mile	15.91	13.36	14.42	28.90	215.12	278.08	120.68	60.16	26.38	25.46	12.98	....	811.43

NOTE.—Ice conditions Jan. 1-Feb. 28. Discharge estimated from measurements.

RIO GRANDE NEAR DEL NORTE

This station, maintained during 1911 and 1912 by the State, is located on a highway bridge about six miles above Del Norte.

The equipment consists of a chain gauge and an automatic gauge located on the bridge.

The bed of the stream is composed of boulders and changed slightly during the high water of October, 1911. During this high water both banks overflowed.

The observer at this station is Jas. G. Duncan, who is paid $5.00 per month.

DISCHARGE MEASUREMENTS OF RIO GRANDE NEAR DEL NORTE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Jan. 20*	G. H. Russell	179	1.60	1.98	287
Feb. 26	Clayton & Turner	224	1.10	0.68	246
Mar. 29	B. S. Clayton	299	1.44	1.04	431
Apr. 29	B. S. Clayton	543	3.60	2.55	1,955
June 3	B. S. Clayton	822	6.44	4.27	5,300
July 5	B. S. Clayton	713	5.40	3.74	3,850
Sept. 10	C. E. Turner	320	1.76	1.34	565
Oct. 16	B. S. Clayton	662	2.10	2.15	1,390
1912 Jan. 12*	B. S. Clayton	228	1.75	1.58	400
Feb. 25*	B. S. Clayton	109	2.43	1.30	265
Apr. 3	B. S. Clayton	437	1.20	1.12	526
Apr. 9	B. S. Clayton	468	1.56	1.46	731
May 12	B. S. Clayton	742	3.25	2.90	2,415
June 6	C. C. Hezmalhalch	1,105	5.61	4.81	6,201
Aug. 22	C. C. Hezmalhalch	531	1.29	1.38	687
Sept. 14	C. E. Turner	510	0.90	1.10	459
Nov. 15	C. E. Turner	236	0.87	0.59	206

*Ice conditions.

DISCHARGE OF RIO GRANDE NEAR DEL NORTE FOR 1911

Drainage Area, 1,400 Square Miles. Altitude, 7,870 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	225	200	245	245	750	1,320	4,920	3,920	1,520	810	2,190	678	450	
2	225	200	225	295	750	1,260	5,250	4,100	1,400	765	2,420	678	450	
3	248	200	225	295	750	1,370	5,160	4,480	1,460	765	1,910	678	450	
4	248	200	245	295	790	1,650	5,470	4,280	1,220	765	1,580	555	450	
5	270	200	225	245	710	2,150	5,470	3,590	1,110	765	10,700	555	450	
6	180	200	200	245	635	2,870	5,650	3,400	1,000	720	14,000	555	450	
7	180	200	245	225	560	3,470	5,630	3,140	1,000	635	6,370	555	450	
8	202	200	245	245	560	3,740	5,740	3,060	955	595	4,540	555	450	
9	248	225	245	270	560	4,420	6,450	2,570	810	555	3,580	555	450	
10	248	225	270	345	598	4,220	6,250	2,420	810	555	2,900	555	450	
11	270	225	270	425	598	3,480	6,000	2,260	810	555	2,730	555	450	
12	270	250	270	320	635	3,220	5,780	2,120	635	555	2,260	555	400	
13	248	250	245	270	635	3,230	5,450	2,120	810	555	1,980	555	400	
14	225	250	225	270	560	2,980	5,330	3,960	810	635	1,710	555	400	
15	180	250	245	248	560	2,980	4,920	3,060	678	635	1,580	555	400	
16	202	280	225	270	672	3,000	4,680	2,650	720	555	1,400	555	400	
17	180	280	225	295	920	3,180	4,480	2,420	765	555	1,340	518	425	
18	180	287	225	320	790	3,540	4,280	2,260	720	555	1,280	518	425	
19	180	287	245	295	832	3,920	4,350	2,490	765	635	1,160	518	425	
20	202	287	225	345	1,010	3,150	4,450	2,730	720	720	1,060	518	400	
21	202	287	245	320	1,210	3,030	4,630	2,650	810	595	905	518	400	
22	225	287	225	425	1,370	2,950	4,620	2,420	1,220	480	905	518	380	
23	202	287	270	370	1,490	3,320	4,330	2,490	1,400	635	905	518	380	
24	225	287	245	320	1,370	3,950	4,310	2,650	1,110	678	905	518	380	
25	225	287	245	398	1,260	4,350	3,910	2,420	1,000	720	905	518	350	
26	225	270	246	370	1,320	4,550	3,500	2,650	905	810	858	518	350	
27	225	270	225	295	1,690	4,200	3,410	2,340	1,110	1,000	858	480	350	
28	225	270	225	398	1,760	4,200	3,410	2,190	1,000	720	858	480	350	
29	225	270	....	490	1,900	4,200	3,280	2,190	1,000	720	720	450	350	
30	225	245	....	598	1,490	4,040	3,380	1,910	905	810	765	450	350	
31	225	245	....	672	....	4,620	....	1,710	810	....	720	....	350	
Total	6,470	7,701	6,696	10,419	28,735	102,860	144,490	86,650	29,988	20,053	75,994	16,289	12,615	Year 1911
Mean	221	248	239	336	958	3,318	4,816	2,795	967	668	2,451	543	407	1,486
Maximum	270	287	270	672	1,900	4,620	6,450	4,480	1,520	1,000	14,000	678	450	14,000
Minimum	180	200	200	225	560	1,260	3,280	1,710	635	555	720	450	350	200
Run-off per square mile	0.158	0.177	0.171	0.240	0.684	2.370	3.440	1.996	0.691	0.477	1.751	0.388	0.291	1.061
Run-off, depth, inches	0.182	0.204	0.178	0.277	0.763	2.732	3.838	2.301	0.796	0.532	2.019	0.433	0.335	14.408
Run-off, acre-feet	13,567	15,275	13,281	20,666	56,995	204,020	286,592	171,868	59,480	39,774	150,732	32,309	25,021	1,076,029
Acre-feet per square mile	9.69	10.91	9.49	14.76	40.72	145.75	204.75	122.75	42.49	28.41	107.70	23.08	17.87	768.58

NOTE.—Ice conditions Dec. 24, 1910-Feb 28, 1911, Nov. 27-Dec. 31, 1911. Discharge estimated from measurements.

DISCHARGE OF RIO GRANDE NEAR DEL NORTE FOR 1912

Drainage Area, 1,400 Square Miles. Altitude, 7,870 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	350	300	265	340	1,560	6,170	3,320	1,430	680	340	420	....	
2	350	300	265	392	1,900	5,950	2,960	1,255	578	340	420	....	
3	375	300	265	480	1,625	6,610	2,350	1,100	512	340	420	....	
4	350	325	265	480	1,200	6,720	2,430	955	512	340	392	....	
5	325	300	265	480	1,150	6,940	2,045	1,000	512	392	392	....	
6	325	300	250	512	1,150	6,060	1,900	910	480	392	365	....	
7	375	325	250	610	1,430	5,840	1,900	830	480	420	340	....	
8	375	325	250	715	2,120	5,950	1,900	790	450	450	340	....	
9	400	325	250	750	2,515	5,840	1,830	750	480	420	340	....	
10	400	300	270	1,000	1,830	5,520	1,690	715	480	420	292	....	
11	400	275	270	790	1,690	5,415	1,690	645	480	420	292	....	
12	400	275	292	790	2,120	4,080	1,690	610	480	420	270	....	
13	400	265	270	750	2,515	3,785	1,760	715	480	420	250	....	
14	350	265	250	480	2,120	3,785	1,625	750	480	392	250	....	
15	350	265	270	545	1,760	3,880	1,625	1,150	450	392	212	....	
16	325	265	292	480	1,560	3,880	1,560	1,100	450	392	212	....	
17	275	265	270	420	2,780	3,595	1,560	910	450	392	212	....	
18	300	240	230	392	3,880	2,960	1,370	1,050	420	392	212	....	
19	300	215	292	392	4,890	2,600	1,430	910	420	392	212	....	
20	300	215	340	392	5,310	2,600	1,430	870	392	392	195	....	
21	300	215	340	340	5,840	2,780	1,200	790	392	392	195	....	
22	300	240	315	315	6,170	2,960	1,200	715	392	365	195	....	
23	275	265	315	340	5,950	3,500	1,430	578	392	365	180	....	
24	325	265	270	512	6,060	3,785	1,495	545	392	365	180	....	
25	350	265	250	750	6,390	3,595	1,430	480	365	365	180	....	
26	350	240	250	715	6,610	3,320	1,370	480	365	365	180	....	
27	350	240	292	578	6,390	3,320	1,430	450	365	365	180	....	
28	325	265	292	680	6,610	3,230	1,430	480	365	365	180	....	
29	325	265	315	750	6,720	3,410	1,690	750	365	365	180	....	
30	325	....	315	1,150	6,940	3,140	1,970	715	365	365	180	....	
31	300	....	315	....	6,830	....	1,625	750	....	392	....	....	
Total	10,550	7,905	8,640	17,320	115,615	131,220	54,335	25,178	13,404	11,927	7,868	....	Period
Mean	340	272	279	577	3,730	4,374	1,753	812	417	385	262	....	1,206
Maximum	400	325	340	1,150	6,940	6.940	3,320	1,430	680	450	420	....	6,940
Minimum	275	215	230	315	1,150	2,600	1,200	450	365	340	180	....	180
Run-off per square mile	0.243	0.194	0.199	0.412	2.664	3.124	1.252	0.580	0.319	0.275	0.187	....	0.861
Run-off, depth, inches	0.280	0.209	0.229	0.460	3.071	3.485	1.443	0.669	0.356	0.317	0.209	....	10.728
Run-off, acre-feet	20,926	15,679	17,137	34,354	229,322	260,275	107,773	49,940	26,587	23,658	15,606	....	801,257
Acre-feet per square mile	14.95	11.20	12.24	24.54	163.80	185.91	76.98	35.67	18.99	16.90	11.15	....	572.33

NOTE.—Ice conditions Jan. 1-Mar. 14. Discharge estimated from measurements.

RIO GRANDE NEAR LOBATOS

This station was maintained during 1911 and 1912 by the State and is located on a highway bridge about six miles above the Colorado-New Mexico line.

The equipment consists of automatic and chain gauges.

The bed of the stream is composed of sand and boulders and has remained permanent for several years.

The observer is Roman Mondragon, who is paid $5.00 per month.

DISCHARGE MEASUREMENTS OF RIO GRANDE NEAR LOBATOS

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 26*	G. H. Russell	361	1.24	1.94	449
	Feb. 23*	Clayton & Turner	374	0.89	2.00	331
	Mar. 7	G. H. Russell	356	1.20	1.73	426
	Mar. 27	B. S. Clayton	114	3.36	1.70	385
	Apr. 19	G. H. Russell	264	0.73	1.38	194
	Apr. 27	B. S. Clayton	548	2.08	2.57	1,139
	May 29	B. S. Clayton	795	2.91	3.62	2,310
	July 3	B. S. Clayton	1,111	3.59	4.81	3,990
	Sept. 2	I. G. Ferguson	378	2.21	2.40	833
	Sept. 7	B. S. Clayton	437	1.64	2.25	719
	Oct. 9	B. S. Clayton	1,600	4.44	6.72	7,100
	Oct. 18	B. S. Clayton	804	2.84	3.62	2,280
1912	Jan. 18*	B. S. Clayton	332	1.54	3.00	510
	Feb. 28	B. S. Clayton	354	1.30	2.45	460
	May 13	B. S. Clayton	747	2.70	3.38	2,020
	June 9	C. C. Hezmalhalch	1,585	4.28	6.50	6,791
	July 12	C. C. Hezmalhalch	360	1.14	1.75	410
	Aug. 23	C. C. Hezmalhalch	314	0.88	1.60	276
	Nov. 16	C. E. Turner	337	1.10	1.75	370

*Ice conditions.

DISCHARGE OF RIO GRANDE NEAR LOBATOS FOR 1911

Drainage Area, 7,700 Square Miles.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	272	250	450	460	345	1,200	2,780	2,065	2,195	900	1,200	1,410	....	
2	295	250	450	460	345	1,000	2,960	2,460	1,870	850	2,000	1,300	....	
3	295	250	400	460	372	900	3,150	3,700	1,410	752	2,670	1,300	....	
4	320	250	400	530	400	1,050	3,340	4,310	1,100	705	2,810	1,200	....	
5	272	250	400	400	400	1,250	3,520	4,950	800	705	2,880	1,100	....	
6	250	275	400	400	372	1,575	3,710	5,110	615	660	4,230	1,100	....	
7	250	275	400	345	320	2,000	4,150	5,110	400	705	6,975	....	....	
8	300	275	400	320	295	2,600	4,230	4,790	250	660	6,890	....	....	
9	300	300	375	320	272	3,325	4,550	4,390	185	615	6,895	....	....	
10	300	300	375	345	250	3,925	5,030	4,075	135	530	7,510	....	....	
11	300	350	375	345	228	4,000	5,350	3,550	135	460	6,805	....	....	
12	300	350	375	400	228	3,550	5,590	3,100	110	495	5,750	....	....	
13	330	350	400	430	205	2,740	5,750	2,880	85	460	4,710	....	....	
14	330	400	400	430	205	2,130	5,430	2,880	75	495	3,850	....	....	
15	330	400	400	400	150	2,130	4,870	3,250	75	615	3,250	....	....	
16	300	400	400	372	150	2,130	4,710	3,625	75	660	2,670	....	....	
17	300	400	400	345	135	2,000	4,390	3,625	65	660	2,390	....	....	
18	300	400	400	345	165	1,810	4,150	3,475	98	660	2,260	....	....	
19	300	400	350	320	185	1,870	3,850	3,325	98	615	2,195	....	....	
20	300	400	330	345	205	2,130	3,850	3,625	98	615	2,065	....	....	
21	300	450	330	345	228	2,065	3,850	3,850	98	752	1,870	....	....	
22	300	450	330	345	320	1,690	4,150	4,150	122	850	1,690	....	....	
23	300	450	330	372	490	1,410	4,630	3,850	150	850	1,630	....	....	
24	300	450	330	400	660	1,410	4,790	3,550	495	800	1,630	....	....	
25	300	450	330	400	705	1,650	4,790	3,475	1,000	705	1,520	....	....	
26	250	449	330	372	705	1,810	4,150	3,475	950	705	1,520	....	....	
27	250	450	400	345	1,100	1,980	3,250	3,250	1,000	705	1,465	....	....	
28	250	450	400	320	1,410	2,140	3,025	3,250	1,000	800	1,520	....	....	
29	250	450	....	320	1,465	2,320	2,390	3,250	1,100	950	1,575	....	....	
30	250	450	....	320	1,520	2,410	2,195	2,810	1,150	1,050	1,520	....	....	
31	250	450	....	320	....	2,590	....	2,530	1,000	....	1,465	....	....	
Total	8,944	11,474	10,630	11,631	13,835	64,790	122,580	111,735	17,939	20,984	97,420	7,410	....	Period 1911
Mean	285	370	380	375	461	2,090	4,086	3,604	579	699	3,143	1,235	....	1,582
Maximum	330	450	450	530	1,520	4,000	5,750	5,110	2,195	1,050	7,510	1,410	....	7,510
Minimum	250	250	330	320	135	900	2,195	2,065	65	460	1,200	1,100	....	65
Run-off per square mile	0.037	0.048	0.049	0.049	0.060	0.271	0.531	0.468	0.075	0.091	0.408	0.160	....	0.206
Run-off, depth, inches	0.043	0.056	0.051	0.056	0.067	0.312	0.592	0.540	0.085	0.101	0.471	0.036	....	2.363
Run-off, acre-feet	17,740	22,758	21,086	23,070	27,441	128,509	243,134	221,623	35,581	41,621	193,230	14,698	....	972,751
Acre-feet per square mile	2.30	2.96	2.74	3.00	3.56	16.70	31.58	28.78	4.62	5.41	25.10	1.81	....	126.42

NOTE.—Ice conditions Dec. 4, 1910-Feb. 28, 1911. Discharge estimated from measurements.

DISCHARGE OF RIO GRANDE NEAR LOBATOS FOR 1912

Drainage Area, 7,700 Square Miles.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	450	510	475	530	1,050	8,140	3,550	660	165	228	345	....	
2	450	510	475	572	1,575	7,870	3,475	615	205	228	372	....	
3	450	510	460	572	2,195	7,420	3,175	530	205	228	372	....	
4	475	530	470	753	2,460	7,150	2,600	460	205	228	400	....	
5	475	530	480	1,100	1,870	6,975	2,130	372	165	250	400	....	
6	475	510	480	1,250	1,520	6,890	1,870	295	165	250	400	....	
7	475	510	480	1,150	1,410	7,240	1,410	250	135	250	400	....	
8	475	510	500	1,150	1,690	7,240	950	205	135	345	400	....	
9	500	500	500	1,300	2,195	6,805	705	165	135	345	400	....	
10	500	490	500	1,355	2,600	6,550	615	135	135	345	400	....	
11	500	500	550	1,520	2,390	6,070	495	110	135	345	400	....	
12	500	500	550	1,410	2,130	5,910	345	110	135	345	400	....	
13	500	490	550	1,150	2,065	5,350	250	110	135	345	400	....	
14	500	490	575	1,000	2,130	4,870	185	122	135	345	372	....	
15	510	490	615	850	2,460	4,310	227	110	150	345	400	....	
16	510	490	615	705	2,260	4,000	185	135	165	320	400	....	
17	510	480	660	900	2,325	3,925	227	185	295	295	400	....	
18	510	490	660	900	2,740	3,925	205	250	295	320	400	....	
19	510	475	705	850	3,775	3,775	205	320	250	295	400	....	
20	510	475	800	753	5,030	3,400	185	295	250	272	400	....	
21	510	470	850	615	6,470	3,100	150	295	250	250	372	....	
22	500	450	850	530	6,890	2,880	150	345	205	250	345	....	
23	510	440	705	460	7,510	3,025	165	345	250	250	345	....	
24	500	430	660	460	7,780	3,550	165	295	250	250	345	....	
25	500	430	660	460	7,780	4,000	165	228	228	250	295	....	
26	525	490	660	530	7,780	4,230	122	295	228	250	295	....	
27	525	470	530	530	8,230	4,150	165	400	205	250	205	....	
28	510	460	572	572	8,500	4,000	165	345	228	250	205	....	
29	510	475	615	530	8,680	3,850	165	295	228	250	345	....	
30	510	....	660	753	8,230	3,625	205	250	228	250	295	....	
31	530	....	660	....	8,320	....	345	205	....	345	....	....	
Total	15,415	14,105	18,522	25,210	132,040	154,225	24,951	8,732	5,895	8,769	10,908	....	Period
Mean	497	486	597	840	4,259	5,141	805	282	196	283	364	....	1,250
Maximum	530	530	850	1,520	8,680	8,140	3,550	660	295	345	400	....	8,680
Minimum	450	430	460	460	1,050	2,880	122	110	135	228	205	....	110
Run-off per square mile	0.065	0.063	0.078	0.109	0.553	0.668	0.105	0.037	0.025	0.037	0.047	....	0.162
Run-off, depth, inches	0.075	0.068	0.090	0.122	0.638	0.745	0.121	0.043	0.028	0.043	0.052	....	2.025
Run-off, acre-feet	30,575	27,977	36,738	50,004	261,901	305,905	49,490	17,320	11,693	17,393	21,636	....	830,632
Acre-feet per square mile	3.97	3.63	4.77	6.49	34.01	39.73	6.43	2.25	1.52	2.26	2.81	....	107.87

NOTE.—Ice conditions Jan. 1-Mch. 12. Discharge estimated from measurements.

SOUTH FORK RIO GRANDE AT SOUTH FORK

This station is located on a highway bridge about one-half mile above South Fork station on the Creede branch of the Denver & Rio Grande railroad.

In October, 1911, the bridge on which old gauge was located was washed out by floods. From this time until May, 1912, a temporary gauge, located on the railroad bridge about one-fourth mile below, was read.

The present equipment consists of a chain gauge located on the highway bridge. There is no relation between the old and new gauges.

The bed of the stream is composed of sand and gravel which changes during extreme high water.

The observers during 1911 and 1912 were Lelia Singles and Maggie Breen, who received $5.00 per month.

DISCHARGE MEASUREMENTS OF SOUTH FORK RIO GRANDE AT SOUTH FORK

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 20*	G. H. Russell	20	1.85	....	37
	Feb. 26*	Clayton & Turner	53	0.64	2.00	34
	Mar. 29	B. S. Clayton	83	1.67	1.85	139
	Apr. 30	B. S. Clayton	143	2.64	2.60	378
	Apr. 30	B. S. Clayton	142	2.60	2.58	369
	June 3	B. S. Clayton	183	6.01	3.78	1,100
	July 18	B. S. Clayton	140	2.79	2.59	391
	Sept. 10	B. S. Clayton	73	1.51	1.67	110
	Oct. 16†	B. S. Clayton	98	2.78	2.40	272
	Nov. 19†	B. S. Clayton	54	2.18	1.92	118
1912	Jan. 20*†	B. S. Clayton	33	1.64	....	54
	Feb. 26*†	B. S. Clayton	28	1.78	2.30	50
	Apr. 4†	B. S. Clayton	49	2.73	1.93	134
	May 12	B. S. Clayton	194	2.78	2.12	540
	June 5	C. C. Hezmalhalch	351	4.30	3.22	1,510
	July 11	C. C. Hezmalhalch	175	2.07	1.73	362
	Aug. 23	C. C. Hezmalhalch	46	1.69	0.82	78
	Sept. 13	C. E. Turner	86	0.79	0.65	59
	Oct. 17	C. E. Turner	88	0.76	0.74	67
	Nov. 15	C. E. Turner	91	0.80	0.79	73

*Ice conditions. †Gauge at railroad bridge.

DISCHARGE OF SOUTH FORK RIO GRANDE AT SOUTH FORK FOR 1911

Drainage Area, 216 Square Miles. Altitude, 8,188 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	30	35	34	134	528	1,166	1,127	240	170	582	140	140	
2	....	30	35	34	123	430	1,206	1,014	240	145	477	140	140	
3	....	30	35	34	182	430	1,166	1,621	272	170	256	140	140	
4	....	30	35	34	182	582	1,206	1,578	225	145	272	140	140	
5	....	30	35	34	182	1,052	1,326	1,166	210	123	....	140	140	
6	....	30	34	34	157	977	1,492	833	170	134	....	140	140	
7	....	37	34	34	225	869	1,621	977	157	123	....	155	140	
8	....	37	34	34	182	977	1,754	670	157	123	....	155	140	
9	....	37	34	34	182	765	2,029	765	157	102	....	140	130	
10	....	40	34	45	157	1,052	1,578	640	157	102	....	140	130	
11	....	40	34	45	112	869	1,937	528	134	102	....	140	130	
12	....	40	34	40	170	905	1,845	640	112	102	....	140	116	
13	....	40	34	34	157	869	1,754	799	123	102	....	140	116	
14	....	40	34	34	157	905	1,492	733	157	92	....	140	116	
15	....	40	34	34	157	977	977	833	112	92	....	140	116	
16	....	37	34	34	182	765	941	670	92	84	272	140	116	
17	....	37	34	34	210	765	905	640	102	92	272	140	100	
18	....	37	32	45	290	799	905	454	84	92	230	140	100	
19	....	37	32	55	182	833	1,052	454	102	256	230	140	100	
20	....	37	32	70	256	765	1,014	454	102	225	230	140	80	
21	....	37	30	92	307	582	941	430	326	182	200	140	80	
22	....	37	30	92	290	640	1,090	430	307	170	200	140	80	
23	....	37	30	92	408	905	977	430	225	145	200	140	80	
24	....	37	30	92	386	833	905	477	196	75	170	140	80	
25	....	37	32	92	408	582	869	430	170	92	170	140	80	
26	....	37	34	75	430	941	905	386	134	196	170	140	80	
27	....	37	34	92	386	941	833	386	123	307	155	140	70	
28	....	37	34	102	454	1,014	733	365	146	256	155	140	70	
29	....	37	....	146	670	977	670	325	170	210	140	140	70	
30	....	37	....	157	477	905	977	325	170	134	140	140	70	
31	....	37	....	210	....	905	....	272	182	....	140	....	70	
Total	....	1,123	933	2,018	7,795	25,339	36,266	20,854	5,254	4,343	4,661	4,230	3,300	Period 1911
Mean	....	36	33	65	260	817	1,209	673	169	145	233	141	106	328
Maximum	....	40	35	210	670	1,052	2,029	1,621	326	307	582	155	140	2,029
Minimum	....	30	30	34	112	430	670	272	84	75	140	140	70	30
Run-off per square mile	....	0.167	0.153	0.301	1.204	3.782	5.597	3.116	0.784	0.671	1.079	0.653	0.491	1.519
Run-off, depth, inches	....	0.192	0.159	0.347	1.343	4.360	6.245	3.592	0.904	0.749	0.803	0.728	0.548	19.998
Run-off, acre-feet	....	2,228	1,851	4,003	15,461	50,259	71,933	41,363	10,421	8,614	9,245	8,390	6,545	230,313
Acre-feet per square mile	....	10.31	8.57	18.53	71.58	232.68	333.02	191.50	48.25	39.88	42.80	38.84	30.30	1,066 26

NOTE.—Ice conditions Jan. 1-Mch. 23, Dec. 17-31. Discharge estimated from measurements.

DISCHARGE OF SOUTH FORK RIO GRANDE AT SOUTH FORK FOR 1912

Drainage Area, 216 Square Miles. Altitude, 8,188 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	70	50	55	100	510	1,390	635	152	62	62	165	....	
2	70	50	55	110	540	1,390	600	140	62	95	165	....	
3	70	50	55	120	332	1,610	540	95	62	52	105	....	
4	70	50	55	132	290	1,500	540	95	62	75	115	....	
5	70	50	55	132	355	1,610	430	115	62	95	115	....	
6	60	50	60	132	270	1,500	405	105	68	62	115	....	
7	60	50	60	132	428	1,610	430	85	57	62	95	....	
8	60	50	60	132	600	1,555	380	75	57	62	75	....	
9	60	50	60	83	510	1,500	360	95	62	75	75	....	
10	60	50	60	83	428	1,180	340	75	68	62	62	....	
11	60	50	60	270	540	1,080	320	95	62	52	52	....	
12	60	50	60	185	540	990	340	95	62	57	62	....	
13	55	50	60	145	510	900	280	75	45	52	95	....	
14	55	50	60	145	510	820	340	165	52	52	75	....	
15	55	50	60	145	455	990	320	140	52	52	95	....	
16	55	50	70	100	600	990	300	105	52	62	85	....	
17	55	50	70	92	780	900	225	95	52	45	75	....	
18	55	50	70	92	1,080	670	260	85	45	52	75	....	
19	55	50	70	92	1,610	670	242	85	45	68	75	....	
20	55	50	70	83	1,445	600	242	85	45	75	75	....	
21	55	50	70	145	1,720	670	225	85	45	68	75	....	
22	55	50	70	100	1,500	820	190	75	45	52	68	....	
23	55	50	70	100	1,445	945	225	62	48	45	62	....	
24	55	50	80	145	1,280	1,130	242	62	45	57	62	....	
25	55	50	80	230	1,390	900	225	62	45	68	57	....	
26	55	50	80	132	1,445	990	190	62	52	68	75	....	
27	55	50	80	132	1,445	990	225	62	45	62	75	....	
28	55	50	90	200	1,500	945	190	62	45	190	95	....	
29	55	50	90	332	1,555	860	165	62	62	115	95	....	
30	55	....	90	400	1,610	900	165	62	57	152	95	....	
31	55	....	90	....	1,500	....	165	95	....	165	....	....	
Total	1,815	1,450	2,115	4,421	28,723	32,605	9,736	2,808	1,623	2,311	2,610	....	Period
Mean	59	50	68	147	927	1,087	314	91	54	75	87	....	269
Maximum	70	50	90	400	1,720	1,610	635	165	68	165	165	....	1,720
Minimum	55	50	55	83	270	600	165	62	45	45	52	....	45
Run-off per square mile	0.273	0.231	0.315	0.681	4.292	5.032	1.454	0.421	0.250	0.347	0.403	....	1.246
Run-off, depth, inches	0.315	0.249	0.363	0.760	4.948	5.614	1.676	0.485	0.279	0.400	0.450	....	15.539
Run-off, acre-feet	3,600	2,876	4,195	8,769	56,972	64,672	19,312	5,569	3,219	4,583	5,176	....	178,943
Acre-feet per square mile	16.67	13.31	19.42	40.60	263.76	299.41	89.41	25.78	14.90	21.22	23.96	....	828.44

NOTE.—Ice conditions Jan. 1-Apr. 3. Discharge estimated from measurements.

KERBER CREEK NEAR VILLA GROVE

This station, established in October, 1911, is located at the Ellis ranch, about six miles west of Villa Grove, and was maintained in co-operation with Mr. Whiteman, of Villa Grove.

The observer was Mrs. George Ellis, who was paid by Mr. Whiteman.

The station was abandoned after June 30, 1912.

DISCHARGE MEASUREMENTS OF KERBER CREEK NEAR VILLA GROVE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Oct. 17	B. S. Clayton	11	0.88	1.01	10
Nov. 20	B. S. Clayton	11	1.04	1.10	12
1912 Jan. 15*	B. S. Clayton	3.2	1.25		4.0
Feb. 25*	C. C. Hezmalhalch	5.4	0.94		5.1
Apr. 6	B. S. Clayton	10	1.99	1.20	20
May 10	B. S. Clayton	14	2.36	1.37	33
July 13	C. C. Hezmalhalch	12	1.24	1.10	15
Sept. 16	C. E. Turner	11	0.64	0.95	6.8

*Ice conditions.

DISCHARGE OF KERBER CREEK AT ELLIS RANCH NEAR VILLA GROVE FOR 1911

Drainage Area, 80 Square Miles. Altitude, 7,970 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1												14	10	
2												14	10	
3												14	10	
4												14	10	
5												14	10	
6												14	10	
7												14	8	
8												14	8	
9												14	8	
10												14	8	
11												9	8	
12												12	8	
13												20	8	
14												27	8	
15												20	6	
16												20	6	
17												17	6	
18											9	20	6	
19											9	20	6	
20											12	20	6	
21											14	20	6	
22											20	17	6	
23											27	14	6	
24											20	12	4	
25											14	12	4	
26											14	12	4	
27											14	12	4	
28											14	12	4	
29											14	10	4	
30											14	10	4	
31													4	
Total											195	456	210	Period
Mean											15	15	7	12
Maximum											27	27	10	27
Minimum											9	9	4	4
Run-off per square mile											0.188	0.188	0.088	0.150
Run-off, depth, inches											0.091	0.210	0.102	0.403
Run-off, acre-feet											387	904	416	1,707
Acre-feet per square mile											4.84	11.30	5.20	21.34

NOTE.—Ice conditions Nov. 21-Dec. 31. Discharge estimated from measurements.

DISCHARGE OF KERBER CREEK NEAR VILLA GROVE FOR 1912

Drainage Area, 80 Square Miles. Altitude, 7,970 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	4	4	5	18	27	153	....	....	....	....	....	....	
2	4	4	5	18	32	144	....	....	....	....	....	....	
3	4	4	5	20	36	108	....	....	....	....	....	....	
4	4	5	7	20	32	108	....	....	....	....	....	....	
5	4	5	7	20	27	84	....	....	....	....	....	....	
6	4	5	7	20	27	84	....	....	....	....	....	....	
7	4	5	7	20	27	84	....	....	....	....	....	....	
8	4	5	7	32	32	77	....	....	....	....	....	....	
9	4	5	10	32	32	70	....	....	....	....	....	....	
10	4	5	10	27	41	70	....	....	....	....	....	....	
11	4	5	10	20	41	64	....	....	....	....	....	....	
12	4	5	10	20	41	57	....	....	....	....	....	....	
13	4	5	10	20	46	57	....	....	....	....	....	....	
14	4	5	10	14	32	57	....	....	....	....	....	....	
15	4	5	10	14	32	57	....	....	....	....	....	....	
16	4	5	12	14	36	52	....	....	....	....	....	....	
17	4	5	12	14	41	46	....	....	....	....	....	....	
18	4	5	12	14	57	46	....	....	....	....	....	....	
19	4	5	12	14	64	41	....	....	....	....	....	....	
20	4	5	12	14	77	41	....	....	....	....	....	....	
21	4	5	14	14	134	46	....	....	....	....	....	....	
22	4	5	14	14	144	46	....	....	....	....	....	....	
23	4	5	14	17	153	46	....	....	....	....	....	....	
24	4	5	14	20	182	46	....	....	....	....	....	....	
25	4	5	14	24	202	52	....	....	....	....	....	....	
26	4	5	14	27	192	57	....	....	....	....	....	....	
27	4	5	14	24	182	57	....	....	....	....	....	....	
28	4	5	16	24	162	57	....	....	....	....	....	....	
29	4	5	16	24	162	57	....	....	....	....	....	....	
30	4	....	16	32	182	57	....	....	....	....	....	....	
31	4	....	16	....	172	....	....	....	....	....	....	....	
Total	124	142	342	605	2,647	2,021	....	....	....	....	....	....	Period
Mean	4	5	11	20	85	67	....	....	....	....	....	....	32
Maximum	4	5	16	32	202	153	....	....	....	....	....	....	202
Minimum	4	4	5	14	27	41	....	....	....	....	....	....	4
Run-off per square mile	0.050	0.061	0.138	0.252	1.068	0.842	....	....	....	....	....	....	0.404
Run-off, depth, inches	0.058	0.066	0.159	0.281	1.232	0.939	....	....	....	....	....	....	2.735
Run-off, acre-feet	246	282	678	1,200	5,250	4,008	....	....	....	....	....	....	11,664
Acre-feet per square mile	3.08	3.52	8.48	15.00	65.62	50.10	....	....	....	....	....	....	145.80

NOTE.—Ice conditions Jan. 1-Apr. 6. Discharge estimated from measurements.

SAN LUIS CREEK NEAR VILLA GROVE

This station is located two and one-half miles east of Villa Grove.
The equipment consists of a staff gauge fastened to log which crosses the stream.
The observers during 1911 and 1912 were Grace Shepard and Helen Fuller, who were paid $5.00 per month.

DISCHARGE MEASUREMENTS OF SAN LUIS CREEK NEAR VILLA GROVE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 July 28	B. S. Clayton	24	2.00	1.68	48
Sept. 11	B. S. Clayton	13	0.89	1.22	11
Oct. 11	B. S. Clayton	18	1.33	1.41	24
Nov. 20	B. S. Clayson	12	0.93	1.22	11
1912 Jan. 13	B. S. Clayton	8	0.66	0.65	5
Feb. 25	C. C. Hezmalhalch	13	0.53	0.82	6.8
Apr. 6	B. S. Clayton	21	2.04	1.22	43
May 10	B. S. Clayton	21	2.20	1.52	46
June 8	C. C. Hezmalhalch	34	2.95	2.05	102
July 13	C. C. Hezmalhalch	15	1.33	1.20	20
Sept. 16	C. E. Turner	12	1.11	1.12	14

DISCHARGE OF SAN LUIS CREEK NEAR VILLA GROVE FOR 1911

Drainage Area, 218 Square Miles. Altitude, 7,962 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1									31	8	23	10		
2									31	13	16	10		
3									36	13	16	10		
4									23	16	16	16		
5									23	16	82	16		
6									20	16	66	16		
7									16	13	31	10		
8									10	10	31	16		
9									6	13	27	16		
10									8	13	23	16		
11									8	13	23	16		
12									8	10	23	16		
13									10	10	23	16		
14									8	13	23	16		
15									6	16	20	16		
16									4	13	20	16		
17									6	10	20	10		
18									8	10	20	10		
19									6	10	20	10		
20									6	16	13	13		
21									6	13	8	13		
22									23	10	10	10		
23									31	10	10	10		
24									20	10	10	10		
25									23	10	16	10		
26									16	13	16	10		
27									16	16	10	10		
28									16	13	16	8		
29									13	16	16	8		
30									10	20	16	6		
31									10		16			
Total									458	383	680	370		Period
Mean									15	13	22	12		16
Maximum									36	20	82	16		82
Minimum									4	8	8	6		4
Run-off per square mile									0.069	0.060	0.101	0.055		0.073
Run-off, depth, inches									0.080	0.067	0.116	0.062		0.331
Run-off, acre-feet									908	760	1,349	734		3,751
Acre-feet per square mile									4.16	3.49	6.19	3.37		17.21

DISCHARGE OF SAN LUIS CREEK NEAR VILLA GROVE FOR 1912

Drainage Area, 218 Square Miles. Altitude, 7,962 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	44	120	44	27	15	....	....	....	
2	....	....	....	....	44	108	35	27	11	....	....	....	
3	....	....	....	....	44	97	27	27	11	....	....	....	
4	....	....	....	....	44	85	27	27	11	....	....	....	
5	....	....	....	....	48	97	27	27	15	....	....	....	
6	....	....	....	....	48	97	20	27	15	....	....	....	
7	....	....	....	....	48	85	20	27	15	....	....	....	
8	....	....	....	....	48	97	15	20	15	....	....	....	
9	....	....	....	....	54	120	15	20	15	....	....	....	
10	....	....	....	....	54	97	11	20	15	....	....	....	
11	....	....	....	....	54	74	15	11	15	....	....	....	
12	....	....	....	....	54	74	15	11	15	....	....	....	
13	....	....	....	....	54	64	20	15	15	....	....	....	
14	....	....	....	....	44	64	20	20	15	....	....	....	
15	....	....	....	....	44	54	20	20	15	....	....	....	
16	....	....	....	....	35	44	20	27	15	....	....	....	
17	....	....	....	....	44	64	27	27	15	....	....	....	
18	....	....	....	....	44	44	27	27	15	....	....	....	
19	....	....	....	....	64	85	27	20	15	....	....	....	
20	....	....	....	....	64	74	35	20	15	....	....	....	
21	....	....	....	....	64	54	35	20	15	....	....	....	
22	....	....	....	....	108	64	27	20	15	....	....	....	
23	....	....	....	....	108	64	35	15	15	....	....	....	
24	....	....	....	....	108	64	35	15	15	....	....	....	
25	....	....	....	....	120	74	35	15	15	....	....	....	
26	....	....	....	....	120	74	27	15	15	....	....	....	
27	....	....	....	....	120	64	27	15	15	....	....	....	
28	....	....	....	....	132	54	35	27	15	....	....	....	
29	....	....	....	....	120	54	35	20	15	....	....	....	
30	....	....	....	....	120	44	35	20	15	....	....	....	
31	....	....	....	....	145	....	27	20	....	....	....	....	
Total	....	....	....	....	2,846	2,254	820	649	438	....	....	....	Period
Mean	....	....	....	....	92	75	26	21	15	....	....	....	46
Maximum	....	....	....	....	145	120	44	27	15	....	....	....	145
Minimum	....	....	....	....	44	44	11	11	11	....	....	....	11
Run-off per square mile	....	....	....	....	0.421	0.344	0.122	0.096	0.067	....	....	....	0.210
Run-off, depth, inches	....	....	....	....	0.485	0.384	0.141	0.111	0.075	....	....	....	1.196
Run-off, acre-feet	....	....	....	....	5,645	4,470	1,626	1,287	869	....	....	....	13,897
Acre-feet per square mile	....	....	....	....	25.90	20.50	7.46	5.90	3.99	....	....	....	63.75

SAGUACHE RIVER NEAR SAGUACHE

This station is located at Ward's ranch, about ten miles above Saguache, and was maintained in co-operation with the Stark-Hagadorn Investment Company.

The equipment consists of an automatic gauge and 2″ x 4″ staff gauge, owned by the Stark-Hagadorn Investment Company.

The bed of the stream is composed of sand, gravel and boulders and is fairly permanent.

Blue prints of automatic gauge records were furnished to the State free of charge.

DISCHARGE MEASUREMENTS OF SAGUACHE CREEK NEAR SAGUACHE

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Mar. 30........	B. S. Clayton..............................	23	1.71	0.50	39
	May 1........	B. S. Clayton..............................	31	2.29	0.75	71
	May 30........	B. S. Clayton..............................	46	3.39	1.27	156
	July 30........	B. S. Clayton..............................	53	3.56	1.52	189
	Sept. 11........	B. S. Clayton..............................	32	2.14	0.74	69
	Oct. 11........	B. S. Clayton..............................	42	3.07	1.04	129
1912	Jan. 14*.......	B. S. Clayton..............................	16	1.81	1.67	29
	Apr. 7........	B. S. Clayton..............................	38	2.13	1.04	82
	May 9........	B. S. Clayton..............................	78	3.44	2.51	268
	June 8........	C. C. Hezmalhalch..........................	95	3.76	2.91	355
	July 13........	C. C. Hezmalhalch..........................	50	2.26	1.38	113
	Sept. 16........	C. E. Turner..............................	40	1.66	1.06	66

*Through holes in ice.

DISCHARGE OF SAGUACHE RIVER NEAR SAGUACHE FOR 1911

Drainage Area, 595 Square Miles. Altitude, 7,800 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	55	71	86	220	192	186	115	93	66	....	
2	....	....	....	55	86	86	220	260	168	107	101	60	....	
3	....	....	....	55	93	86	209	329	159	107	93	53	....	
4	....	....	....	55	71	93	209	290	140	108	109	53	....	
5	....	....	....	55	71	118	218	220	140	108	146	60	....	
6	....	....	....	55	58	135	227	220	124	108	185	60	....	
7	....	....	....	60	51	153	227	259	116	86	169	53	....	
8	....	....	....	60	51	162	237	269	116	78	125	53	....	
9	....	....	....	60	39	181	246	219	116	86	118	53	....	
10	....	....	....	60	39	172	256	191	117	78	129	48	....	
11	....	....	....	60	34	153	236	182	117	71	122	60	....	
12	....	....	....	60	34	144	217	200	109	64	105	48	....	
13	....	....	....	64	29	144	217	190	135	58	130	48	....	
14	....	....	....	64	24	126	206	217	127	58	122	48	....	
15	....	....	....	64	29	135	235	208	127	39	122	48	....	
16	....	....	....	64	51	135	235	197	102	29	113	45	....	
17	....	....	....	64	58	126	225	160	102	24	113	45	....	
18	....	....	....	64	58	126	234	189	111	20	81	45	....	
19	....	....	....	64	64	144	224	246	103	20	74	45	....	
20	....	....	....	64	78	135	224	246	103	20	81	45	....	
21	....	....	....	71	86	126	224	255	104	20	89	45	....	
22	....	....	....	78	101	144	283	255	166	29	89	45	....	
23	....	....	....	71	109	144	233	226	233	58	97	40	....	
24	....	....	....	71	109	162	204	216	167	58	97	40	....	
25	....	....	....	64	86	172	194	216	130	58	97	40	....	
26	....	....	....	51	86	181	175	244	130	58	97	40	....	
27	....	....	....	39	101	181	165	264	131	58	97	40	....	
28	....	....	....	39	109	172	156	224	122	58	97	40	....	
29	....	....	....	51	109	172	165	196	114	58	89	35	....	
30	....	....	....	51	93	172	165	196	106	64	89	35	....	
31	....	....	....	58	....	181	....	186	106	....	74	....	....	
Total	....	....	....	1,846	2,078	4,447	6,486	6,962	4,027	1,903	3,343	1,436	....	Period 1911
Mean	....	....	....	60	69	143	216	225	130	63	108	48	....	118
Maximum	....	....	....	78	109	181	283	329	233	115	185	66	....	329
Minimum	....	....	....	39	24	86	156	160	102	20	74	35	....	20
Run-off per square mile	....	....	....	0.108	0.116	0.240	0.363	0.378	0.218	0.106	0.182	0.081	....	0.198
Run-off, depth, inches	....	....	....	0.125	0.130	0.277	0.405	0.436	0.252	0.119	0.210	0.090	....	2.024
Run-off, acre-feet	....	....	....	3,661	4,122	8,820	12,865	13,809	7,987	3,775	6,631	2,848	....	64,519
Acre-feet per square mile	....	....	....	6.15	6.93	14.82	21.62	23.22	13.42	6.34	11.15	4.79	....	108.43

DISCHARGE OF SAGUACHE RIVER NEAR SAGUACHE FOR 1912

Drainage Area, 595 Square Miles. Altitude, 7,800 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				80	224	413	168	131	87				
2				80	268	353	136	131	85				
3				80	215	320	116	131	85				
4				80	116	320	106	131	85				
5				80	98	320	116	131	85				
6				80	90	331	111	131	80				
7				82	121	298	111	131	80				
8				82	198	342	116	131	80				
9				87	268	342	106	131	80				
10				87	224	320	106	131	80				
11				90	183	278	106	131	80				
12				87	183	240	106	131	80				
13				64	224	215	106	131	80				
14				60	183	198	106	131	80				
15				64	136	183	116	183	80				
16				64	136	168	136	183	74				
17				64	155	298	136	162	71				
18				64	249	206	121	142	66				
19				64	320	183	121	116	66				
20				60	353	148	131	106	66				
21				56	377	136	106	98	66				
22				53	401	142	131	90	64				
23				56	401	162	215	84	64				
24				56	377	183	183	84					
25				71	377	155	183	80					
26				71	425	155	131	80					
27				68	425	162	136	80					
28				66	413	155	198	80					
29				102	401	155	176	80					
30				162	401	198	148	84					
31					413		136	87					
Total				2,260	8,355	7,079	4,120	3,653	1,764				Period
Mean				75	270	236	133	118	77				155
Maximum				162	425	413	215	183	87				425
Minimum				53	90	136	106	80	64				53
Run-off per square mile				0.126	0.454	0.397	0.224	0.198	0.129				0.260
Run-off, depth, inches				0.141	0.523	0.443	0.258	0.229	0.110				1.702
Run-off, acre-feet				4,482	16,572	14,041	8,172	7,246	3,499				54,013
Acre-feet per square mile				7.53	27.85	23.60	13.73	12.18	5.88				90.78

NOTE.—Discharge estimated Aug. 2-13, Sept. 2-8.

CONEJOS RIVER NEAR MOGOTE

This station prior to high water of October, 1911, was located at Jacob's ranch about seventeen miles above Antonito. After that time the station was moved to highway bridge near Mogote.

The equipment consists of a chain gauge located on the right side of the highway bridge.

The bed of the stream is composed of gravel and boulders and appears to be permanent.

The observer in 1911 was Francesque Jacob, who was paid $4.00 per month. The observer during 1912 was Dryden Broyles, who received $5.00 per month.

DISCHARGE MEASUREMENTS OF CONEJOS RIVER NEAR MOGOTE

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Jan. 21*	G. H. Russell	34	1.47		50
	Feb. 24*	Clayton & Turner	26	1.20	0.50	31
	Mar. 26	B. S. Clayton	49	1.70	0.43	83
	Apr. 25	B. S. Clayton	227	2.91	1.80	661
	May 28	B. S. Clayton	314	5.00	2.60	1,570
	July 2	B. S. Clayton	463	5.60	3.25	2,590
	Sept. 16	B. S. Clayton	111	2.33	0.99	259
	Nov. 18	B. S. Clayton	77	2.04		157
1912	Jan. 17*	B. S. Clayton	42	1.76		74
	Feb. 27*	B. S. Clayton	42	1.10		46
	Apr. 5	B. S. Clayton	62	3.21	1.24	199
	May 14	B. S. Clayton	174	5.02	2.68	875
	June 10	C. C. Hezmalhalch	360	5.84	4.40	2,108
	July 12	C. C. Hezmalhalch	241	2.63	3.00	634
	Aug. 23	C. C. Hezmalhalch	109	1.06	2.00	115
	Sept. 17	C. E. Turner	52	1.24	1.85	65
	Oct. 18	C. E. Turner	54	1.43	1.93	77
	Nov. 16	C. E. Turner	45	1.73	1.92	78

*Ice conditions.

DISCHARGE OF CONEJOS RIVER NEAR MOGOTE FOR 1911

Drainage Area, 282 Square Miles.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	60	60	60	40	222	560	2,010	1,710	542	290	1,370	....	....	
2	60	60	60	40	222	590	2,500	2,500	455	271	1,070	....	....	
3	60	60	60	40	240	750	2,500	1,940	428	311	728	....	....	
4	60	60	60	40	222	835	2,170	1,710	378	271	648	....	....	
5	60	60	60	40	175	980	2,330	1,710	355	253	4,500	....	....	
6	60	60	60	40	175	1,340	2,330	1,370	332	253	....	....	....	
7	60	55	60	50	147	1,680	2,330	1,300	332	219	....	....	....	
8	60	55	50	50	175	1,830	2,500	1,120	311	204	....	....	....	
9	60	55	50	50	175	1,830	3,040	1,010	271	188	....	....	....	
10	60	55	50	60	175	1,680	2,850	959	253	204	....	....	....	
11	60	55	50	60	161	1,480	2,500	860	253	188	....	....	....	
12	60	55	50	100	175	1,290	2,330	910	253	188	....	....	....	
13	60	50	40	95	175	1,290	2,170	1,070	271	236	....	....	....	
14	60	50	40	95	161	1,160	2,090	1,120	236	188	....	....	....	
15	60	50	40	108	205	1,160	2,010	959	219	271	....	....	....	
16	60	50	40	95	240	1,290	2,010	959	219	236	....	....	....	
17	60	50	40	85	240	1,550	1,860	959	219	219	....	....	....	
18	60	50	40	85	240	1,550	1,780	910	219	188	....	....	....	
19	60	50	31	85	298	1,500	1,860	1,640	271	253	....	....	....	
20	60	50	31	85	440	1,440	2,010	1,300	219	428	....	....	....	
21	60	50	31	75	498	1,180	2,090	1,240	236	332	....	....	....	
22	60	50	31	75	560	1,070	2,170	1,120	482	290	....	....	....	
23	60	50	31	85	592	1,300	2,010	910	610	290	....	....	....	
24	60	50	31	85	592	1,570	1,940	1,010	455	253	....	....	....	
25	60	50	40	85	627	1,860	1,710	860	455	253	....	....	....	
26	60	60	40	85	701	1,860	1,440	860	403	576	....	....	....	
27	60	60	40	95	820	1,640	1,300	728	355	455	....	....	....	
28	60	60	40	108	780	1,570	1,370	728	378	355	....	....	....	
29	60	60	....	147	820	1,570	1,440	686	355	378	....	....	....	
30	60	60	....	147	627	1,710	1,440	648	311	610	....	....	....	
31	60	60	....	175	....	1,860	....	542	271	....	....	....	....	
Total	1,860	1,700	1,256	2,505	10,880	42,975	62,090	35,348	10,347	8,651	8,316	....	....	Period 1911
Mean	60	55	45	81	363	1,386	2,069	1,140	334	288	1,663	....	....	662
Maximum	60	60	60	175	820	1,860	3,040	2,500	610	610	4,500	....	....	4,500
Minimum	60	50	31	40	147	560	1,300	542	219	188	648	....	....	31
Run-off per square mile	0.213	0.195	0.169	0.287	1.287	4.912	7.337	4.043	1.184	1.021	5.897	....	....	2.348
Run-off, depth, inches	0.246	0.225	0.176	0.331	1.486	5.663	8.186	4.661	1.365	1.139	0.879	....	....	24.269
Run-off, acre-feet	3,689	3,372	2,491	4,969	21,580	85,240	123,154	70,113	20,523	17,159	16,495	....	....	365,099
Acre-feet per square mile	13.08	11.96	8.83	17.62	76.52	302.30	436.70	248.60	72.77	60.86	58.50	....	....	1,294.66

NOTE.—Ice conditions Dec. 1, 1910-Mch. 11, 1911. Discharge estimated from measurements.

DISCHARGE OF CONEJOS RIVER NEAR MOGOTE FOR 1912

Drainage Area, 282 Square Miles.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	90	65	45	190	665	2,600	1,170	342	95	48	80	....	
2	90	65	45	190	805	2,175	975	315	68	48	95	....	
3	90	65	45	200	768	2,650	880	342	80	55	80	....	
4	90	65	45	200	545	2,790	790	180	68	55	55	....	
5	90	60	45	200	490	2,370	525	180	68	80	80	....	
6	80	60	50	190	545	2,510	490	180	68	95	68	....	
7	80	60	50	222	885	2,650	635	162	55	80	68	....	
8	80	60	50	235	1,060	2,510	975	145	48	68	68	....	
9	80	60	50	210	1,015	2,580	560	128	68	68	80	....	
10	80	60	60	295	768	2,045	525	110	55	68	95	....	
11	80	60	60	210	768	1,920	560	110	80	80	95	....	
12	80	60	60	210	885	1,500	672	110	80	68	80	....	
13	74	55	60	170	885	1,500	635	95	68	80	80	....	
14	74	55	70	180	768	1,390	672	110	55	68	95	....	
15	74	55	70	170	665	1,920	1,170	525	68	80	80	....	
16	74	55	70	170	845	1,560	790	162	80	68	68	....	
17	74	55	80	170	1,375	1,560	672	110	55	68	68	....	
18	74	50	90	170	1,605	1,280	560	128	68	80	80	....	
19	74	50	100	170	2,110	975	560	110	55	80	68	....	
20	74	50	110	170	2,530	928	525	128	55	95	68	....	
21	74	50	120	155	3,060	1,120	560	145	48	80	95	....	
22	74	50	130	155	3,390	1,390	598	180	55	80	80	....	
23	70	50	140	190	4,290	1,280	525	110	55	55	68	....	
24	70	45	150	265	3,300	1,445	490	95	55	68	68	....	
25	70	45	150	295	3,650	1,280	460	80	55	68	68	....	
26	70	45	150	235	3,460	1,120	460	95	55	80	68	....	
27	70	45	160	265	3,450	1,225	460	80	55	68	128	....	
28	65	45	160	265	3,200	1,225	430	80	55	265	162	....	
29	65	45	160	365	3,420	1,070	430	95	68	145	180	....	
30	65	....	180	545	3,300	1,225	370	68	55	95	110	....	
31	65	....	180	....	2,870	....	342	95	....	95	....	....	
Total	2,360	1,585	2,825	6,657	57,372	51,793	19,466	4,795	1,893	2,531	2,578	....	Period
Mean	76	55	91	222	1,851	1,726	628	155	63	82	86	....	459
Maximum	90	65	180	545	4,290	2,790	1,170	525	95	265	180	....	4,290
Minimum	65	45	45	155	490	928	342	68	48	48	55	....	45
Run-off per square mile	0.270	0.195	0.323	0.787	6.564	6.121	2.227	0.550	0.223	0.290	0.305	....	1.629
Run-off, depth, inches	0.311	0.210	0.372	0.878	7.567	6.829	2.567	0.634	0.249	0.334	0 341	....	20.292
Run-off, acre-feet	4,681	3,144	5,603	13,204	113,798	102,732	38,611	9,511	3,754	5,020	5,113	....	305,171
Acre-feet per square mile	16.60	11.15	19.87	46.82	403.54	364.30	136.92	33.73	13.31	17.80	18.13	....	1,082.17

NOTE.—Ice conditions Jan. 1-Apr. 4. Discharge estimated from measurements.

ALAMOSA RIVER AT TERRACE RESERVOIR

This station was established April 18, 1909, by The San Luis Land and Irrigation Company. It is located 1,000 feet below the Terrace reservoir dam and twenty-four miles northwest of La Jara.

The equipment consists of a staff gauge bolted to a cliff at the lower end of a box canon.

The channel consists of heavy gravel and is fairly permanent.

All flow is regulated by two four-foot circular valves from reservoir, and does not show fluctuations of natural flow.

Records at this station have been furnished by John E. Field, Engineer for The San Luis Land and Irrigation Company.

DICHARGE OF ALAMOSA RIVER AT TERRACE RESERVOIR FOR 1909

Drainage Area, 120 Square Miles. Altitude, 8,400 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					194	411	354			75	35	90	
2					194	469	318			97	35	60	
3					290	645	301			105	25	75	
4					391	722	284			105	35	60	
5					555	874	252			90	35	222	
6					645	874	237			90	35	222	
7					670	978	237			90	35	144	
8					695	874	222			75	35	105	
9					555	941	222			75	35	75	
10					410	740	194			90	35	75	
11					510	722	194			75	45	90	
12					510	645	181			75	35	167	
13					510	722	167			75	35	167	
14					510	695	167			60	35	105	
15					490	645	194			60	35	60	
16					510	645	144			60	75	75	
17					555	645	144			60	90	75	
18				391	622	599	133			60	105	75	
19				555	645	599	122			60	90	60	
20				354	599	645	122			60	60	75	
21				284	490	599	144			45	60	105	
22					429	555	155			45	35	105	
23				194	391	510	167			45	45	122	
24				180	336	510	167			45	45	122	
25				105	318	510	155			35	60	75	
26				133	372	510	144			35	60	75	
27				159	490	490	122			35	45	75	
28				284	555	449	122			35	45	60	
29				194	391	391	105			35	60	60	
30				188	469	354	90			35	60	75	
31					411		82			25		75	
Total				3,021	14,712	18,968	5,642			1,952	1,460	3,026	Period
Mean				252	475	632	182			63	49	98	249
Maximum				555	695	978	354			105	105	222	978
Minimum				105	194	354	82			25	25	60	25
Run-off per square mile				2.100	3.960	5.267	1.517			0.525	0.408	0.817	2.075
Run-off, depth, inches				0.937	4.566	5.877	1.749			0.605	0.455	0.942	15.131
Run-off, acre-feet				5,992	29,181	37,623	11,191			3,872	2,896	6,002	96,757
Acre-feet per square mile				49.93	243.18	313.52	93.26			32.27	24.13	50.02	806.31

DISCHARGE OF ALAMOSA RIVER AT TERRACE RESERVOIR FOR 1910

Drainage Area, 120 Square Miles. Altitude, 8,400 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec	
1	60	....	....	70	469	645	144	122	45	25	....	....	
2	75	....	....	105	429	645	122	105	45	25	....	....	
3	60	....	....	105	391	645	122	105	35	25	....	....	
4	75	....	....	85	391	645	122	90	35	25	....	....	
5	60	....	....	85	391	555	105	222	35	25	....	....	
6	60	....	....	85	469	469	105	167	25	25	....	....	
7	60	....	....	105	429	429	105	144	35	25	....	....	
8	75	....	75	122	469	252	105	105	25	25	....	....	
9	75	....	75	167	510	252	90	105	25	25	....	....	
10	75	....	90	118	599	284	90	144	35	25	....	....	
11	90	....	75	144	645	284	90	144	25	25	....	....	
12	75	....	90	142	645	284	90	167	35	25	....	....	
13	75	....	90	167	645	397	90	167	25	25	....	....	
14	75	....	90	144	599	354	90	167	25	25	....	....	
15	75	....	75	144	510	318	90	167	25	25	....	....	
16	75	....	75	105	469	318	90	167	25	25	....	....	
17	....	....	90	122	429	194	90	144	25	25	....	....	
18	....	....	75	144	429	222	75	122	25	25	....	....	
19	....	....	90	167	429	222	75	105	25	25	....	....	
20	....	....	75	167	391	252	75	105	25	25	....	....	
21	....	....	75	167	391	252	75	90	35	....	....	....	
22	....	....	105	167	318	252	75	75	35	....	....	....	
23	....	....	167	167	284	252	60	45	25	....	....	....	
24	....	....	144	252	252	194	60	45	25	....	....	....	
25	....	....	167	318	252	167	60	45	35	....	....	....	
26	....	....	144	354	429	167	60	45	25	....	....	....	
27	....	....	122	354	469	167	60	45	25	....	....	....	
28	....	....	105	429	555	144	60	45	25	....	....	....	
29	....	....	90	510	645	144	144	45	25	....	....	....	
30	....	....	105	510	645	144	144	45	25	....	....	....	
31	....	....	90	....	645	....	144	45	....	....	....	....	
Total	1,140	....	2,379	5,721	14,623	9,549	2,907	3,334	880	520	....	....	Period
Mean	71	....	99	191	472	318	94	108	29	25	....	....	184
Maximum	90	....	167	510	645	645	144	222	45	25	....	....	645
Minimum	60	....	75	70	252	144	60	45	25	25	....	....	25
Run-off per square mile	0.592	....	0.825	1.583	3.933	2.650	0.784	0.900	0.242	0.208	....	....	1.533
Run-off, depth, inches	0.352	....	0.736	1.766	4.535	2.956	0.904	1.038	0.270	0.155	....	....	12.712
Run-off, acre-feet	2,261	....	4,718	11,348	29,004	18,941	5,766	6,613	1,745	1,031	....	....	81,427
Acre-feet per square mile	18.84	....	39.32	94.57	241.70	157.84	48.05	55.11	14.54	8.59	....	....	678.56

DISCHARGE OF ALAMOSA RIVER AT TERRACE RESERVOIR FOR 1911

Drainage Area, 120 Square Miles. Altitude, 8,400 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				60	222	555	530	235	100	215			
2				75	252	599	670	235	100	255			
3				75	252	599	720	215	100	335			
4				60	284	555	720	215	100	530			
5				60	354	555	670	215	100	1,085			
6				60	469	599	530	215	100	1,310			
7				60	510	599	410	68	100	1,165			
8				60	555	872	335	68	100	810			
9				60	599	1,090	335	68	100	510			
10				60	599	1,090	335	47	100	252			
11				60	555	1,090	335	68	100	144			
12				45	469	645	335	68	100	0			
13				45	429	645	335	100	100	0			
14				45	354	645	335	135	100	0			
15				60	391	645	335	135	100	0			
16				75	429	645	335	135	100	695			
17				105	469	645	235	100	100	695			
18				105	510	645	235	100	100	122			
19				122	555	645	235	100	100	90			
20				122	510	749	235	100	100	90			
21				144	391	808	235	100	215	90			
22				194	391	808	235	100	215	90			
23				194	510	812	235	100	215	90			
24				194	555	808	235	100	175	90			
25				194	599	808	235	100	175	90			
26				222	599	555	235	100	175	90			
27				284	555	429	235	100	100	90			
28				252	510	429	235	100	100	90			
29				284	469	429	235	100	100	90			
30				252	510	510	235	100	135	90			
31					555		235	100		90			
Total				3,628	14,411	20,508	10,790	3,722	3,605	9,293			Period 1911
Mean				121	465	684	348	120	120	300			308
Maximum				284	599	1,090	720	235	215	1,310			1,090
Minimum				45	222	429	235	47	100	0			0
Run-off per square mile				1.008	3.875	5.700	2.900	1.000	1.000	2.500			2.567
Run-off, depth, inches				1.125	4.468	6.359	3.344	1.153	1.116	2.882			20.447
Run-off, acre-feet				7,197	28,584	40,677	21,402	7,383	7,151	18,433			130,827
Acre-feet per square mile				59.98	238.20	338.98	178.35	61.52	59.59	153.71			1,090.33

DISCHARGE OF ALAMOSA RIVER AT TERRACE RESERVOIR FOR 1912

Drainage Area, 120 Square Miles. Altitude, 8,400 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1		53	53	53	166	1,030	480	290	65	43			
2		53	53	53	210	1,030	480	290	65	43			
3		53	53	53	176	1,100	460	290	65	43			
4		53	53	72	156	795	420	290	65	43			
5		53	53	86	146	678	380	290	65	43			
6		53	53	86	176	708	360	290	65	43			
7		53	53	94	240	631	360	290	65	43			
8		53	53	94	360	609	360	290	53	43			
9		53	53	86	305	661	360	290	53	43			
10		53	53	102	225	692	325	290	53	43			
11		53	53	86	198	695	325	288	53	43			
12		53	53	78	240	670	308	286	53	43			
13		53	53	65	240	595	342	180	53	43			
14		53	53	53	240	460	360	122	53	43			
15		53	53	53	240	380	360	104	53	43			
16		53	53	53	240	400	360	126	53	43			
17		53	53	53	360	400	360	142	53	43			
18		53	65	53	528	400	360	130	53	43			
19		53	78	53	650	400	360	96	53	43			
20		53	78	53	825	360	325	94	53	43			
21		53	53	53	890	360	325	94	53	43			
22		53	53	53	925	360	325	94	53	35			
23		53	53	59	1,030	360	325	94	53				
24		53	53	59	1,030	360	325	102	43				
25		53	53	59	995	380	325	86	43				
26		53	53	59	1,030	400	325	78	43				
27		53	53	72	1,030	460	325	78	43				
28		53	53	65	1,030	480	325	86	43				
29		53	53	86	1,030	480	325	65	43				
30			53	136	1,030	480	325	65	43				
31			53		1,030		290	65					
Total		1,537	1,705	2,080	16,971	16,814	10,985	5,375	1,604				Period
Mean		53	55	69	547	561	354	173	52				
Maximum		53	78	136	1,030	1,100	480	290	65				
Minimum		53	53	53	146	360	290	65	43				
Run-off per square mile		0.448	0.458	0.575	4.558	4.675	2.950	1.442	0.433				
Run-off, depth, inches		0.483	0.528	0.642	5.255	5.216	3.401	1.663	0.483				
Run-off, acre-feet		3,148	3,382	4,125	33,662	33,350	21,789	10,661	3,181				
Acre-feet per square mile		26.23	28.18	34.38	280.52	261.25	181.58	88.84	26.51				

San Juan and Dolores Rivers Drainage

SAN JUAN RIVER AT ARBOLES

This station is located about 1,000 feet west of Arboles and above the junction of the San Juan and Piedra rivers.

Until October, 1912, the station was maintained by the State. After October, 1912, it has been maintained in co-operation with the State Engineer of New Mexico.

The equipment consists of a cable of about 200 feet span with car, which replaced cable and car lost in flood of October, 1911, and a chain gauge.

The bed of the stream is composed of cobbles and boulders and is fairly permanent.

The observer is L. E. Smack, who was paid $3.00 per month until October 1, when his salary was increased to $4.00 per month.

DISCHARGE MEASUREMENTS OF SAN JUAN RIVER AT ARBOLES

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 21	Clayton & Turner	92	1.98	1.40	182
	Mar. 25	B. S. Clayton	387	4.07	2.83	1,574
	Apr. 24	B. S. Clayton	544	4.73	3.72	2,576
	May 17	B. S. Clayton	630	5.24	4.10	3,300
	May 26	B. S. Clayton	594	5.12	3.94	3,040
	July 1	B. S. Clayton	668	5.38	4.50	3,590
	Sept. 1	B. S. Clayton	175	2.82	1.91	494
	Dec. 18*	B. S. Clayton	177	1.51	0.60	267
1912	Jan. 26*	B. S. Clayton	130	1.64	....	213
	Mar. 1*	B. S. Clayton	112	1.44	....	161
	Apr. 12	B. S. Clayton	433	3.72	2.84	1,610
	May 10	C. C. Hezmalhalch	537	4.11	3.60	2,209
	June 12	C. C. Hezmalhalch	621	4.61	4.23	2,864
	July 18	C. C. Hezmalhalch	332	2.87	2.10	955
	Aug. 26*	C. C. Hezmalhalch	149	1.66	0.72	247
	Sept. 20	C. E. Turner	78	1.96	0.35	153
	Sept. 20	Gray & O'Brien	80	1.78	0.35	143
	Oct. 7	F. O'Brien	130	2.31	0.91	300
	Oct. 17	F. O'Brien	104	2.25	0.66	234
	Oct. 27	F. O'Brien	95	2.09	0.44	199

*Ice conditions.

DISCHARGE OF SAN JUAN RIVER AT ARBOLES FOR 1911

Drainage Area, 1,394 Square Miles. Altitude, 6,001 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	82	100	125	230	2,450	2,380	3,195	4,140	1,310	580	385	727	550	
2	82	100	125	260	2,745	2,030	4,050	5,880	1,080	580	870	695	550	
3	82	100	125	350	2,520	2,240	4,130	4,210	1,080	535	1,755	665	500	
4	145	100	125	580	2,380	2,380	4,050	3,730	920	490	4,290	695	450	
5	145	100	125	1,690	2,450	3,120	4,210	3,270	820	490	25,000	695	450	
6	195	100	125	2,450	1,690	3,570	4,210	3,045	670	490	11,300	727	400	
7	145	100	125	1,960	1,495	4,210	4,130	2,595	580	420	5,800	727	400	
8	126	100	135	1,690	1,310	4,530	4,210	2,240	580	420	3,710	865	350	
9	145	125	135	1,370	1,080	4,690	5,030	1,960	580	420	3,055	865	350	
10	170	125	150	1,820	1,135	4,370	4,610	1,755	580	420	2,615	830	300	
11	126	125	150	2,380	1,135	4,050	4,210	1,755	580	420	2,095	795	300	
12	108	125	150	1,960	1,430	3,570	3,890	1,960	580	420	1,695	760	300	
13	82	125	150	1,250	1,370	3,195	3,890	1,690	535	490	1,695	760	270	
14	70	125	150	1,190	1,135	2,970	3,810	3,120	535	490	1,695	760	270	
15	108	125	150	1,190	1,250	2,520	3,730	3,345	490	420	1,320	795	267	
16	145	125	150	1,625	1,430	2,820	3,970	2,970	455	350	1,320	865	267	
17	145	125	150	1,690	1,560	3,195	3,970	2,240	490	350	1,280	900	267	
18	145	125	180	1,625	1,560	3,270	3,890	3,270	420	290	1,320	900	267	
19	145	125	180	1,690	1,625	3,570	2,970	3,570	420	290	1,160	935	267	
20	126	135	180	1,495	1,430	3,120	3,270	2,450	455	1,890	1,160	865	267	
21	126	135	160	1,690	2,170	2,450	3,650	5,115	455	580	1,280	795	267	
22	108	135	140	1,625	2,745	2,450	3,730	3,730	1,370	490	1,568	795	267	
23	108	135	140	1,370	2,450	2,745	3,810	2,895	2,895	420	1,568	760	267	
24	95	135	140	1,135	2,595	2,970	3,680	2,380	1,960	350	1,320	695	267	
25	82	135	180	1,310	2,450	3,345	3,260	2,520	1,080	350	1,280	695	267	
26	82	135	180	1,495	2,670	3,195	2,840	2,310	1,135	2,670	1,280	665	267	
27	95	135	180	1,190	2,970	3,120	2,450	2,240	1,080	1,690	1,240	695	267	
28	108	125	230	1,250	2,745	3,045	2,350	2,030	1,025	580	1,240	695	267	
29	95	125	....	1,310	2,820	2,745	2,250	2,030	1,135	2,745	1,160	665	267	
30	95	125	....	1,560	2,520	2,895	2,430	1,820	920	3,120	1,200	575	267	
31	58	125	....	1,960	....	2,895	....	1,560	580	....	1,045	....	267	
Total	3,569	3,755	4,235	44,390	59,315	97,655	109,875	87,825	26,795	23,250	87,701	22,861	9,979	Year 1911
Mean	115	121	151	1,432	1,977	3,150	3,662	2,833	864	775	2,829	762	322	1,583
Maximum	195	135	230	2,450	2,970	4,690	5,030	5,880	2,895	3,120	25,000	935	550	25,000
Minimum	58	100	125	230	1,080	2,030	2,250	1,560	420	290	385	575	267	100
Run-off per square mile	0.082	0.087	0.108	1.027	1.418	2.260	2.627	2.032	0.620	0.556	2.030	0.547	0.231	1.135
Run-off, depth, inches	0.094	0.100	0.113	1.184	1.582	2.605	2.932	2.343	0.715	0.620	2.340	0.610	0.266	15.411
Run-off, acre-feet	7,079	7,448	8,400	88,046	117,650	193,696	217,934	174,198	53,147	46,116	173,955	45,337	19,793	1,145,741
Acre-feet per square mile	5.08	5.36	6.04	63.16	84.40	138.94	156.34	124.96	38.16	33.08	124.79	32.52	14.20	821.91

NOTE.—Ice conditions Jan. 1-Feb. 17, Dec. 1-31, 1911. Discharge estimated from measurements. Discharge on Oct. 5 and Oct. 6, approximate.

DISCHARGE OF SAN JUAN RIVER AT ARBOLES FOR 1912

Drainage Area, 1,394 Square Miles. Altitude, 6,001 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	265	210	160	635	3,405	3,710	2,095	605	235	155	300	....	
2	265	210	160	760	3,555	3,920	1,915	548	235	155	300	....	
3	265	210	160	1,652	3,005	3,972	1,610	495	210	155	265	....	
4	265	210	200	1,825	2,282	3,920	1,160	495	210	340	265	....	
5	265	210	225	1,568	1,780	3,868	1,120	448	210	470	265	....	
6	250	205	250	1,915	1,960	3,920	970	402	210	402	235	....	
7	250	205	275	2,005	2,282	3,762	1,045	380	210	300	235	....	
8	250	205	300	2,710	2,520	3,815	1,008	340	210	300	235	....	
9	250	205	325	1,825	2,615	3,658	935	282	210	282	235	....	
10	250	205	350	2,282	2,188	3,355	900	250	210	265	222	....	
11	230	205	400	1,610	2,140	3,105	865	222	210	235	222	....	
12	230	200	470	1,525	2,188	2,805	865	222	210	210	210	....	
13	230	200	340	1,400	2,188	2,520	795	235	190	210	210	....	
14	230	200	300	1,400	2,188	2,235	830	1,082	190	210	190	....	
15	230	200	282	1,440	2,710	2,615	865	635	190	210	190	....	
16	220	200	265	1,400	2,955	2,615	1,240	320	190	210	190	....	
17	220	190	210	1,240	3,455	2,615	795	265	190	210	170	....	
18	220	190	210	1,200	3,972	2,050	1,008	265	170	210	170	....	
19	220	190	3,762	1,200	4,460	2,005	970	282	170	200	170	....	
20	220	190	4,240	1,045	3,710	1,780	865	282	155	190	170	....	
21	220	190	1,960	935	3,972	1,825	760	265	155	170	170	....	
22	220	180	1,610	900	4,025	1,738	695	265	155	170	170	....	
23	215	180	1,200	970	3,972	2,188	865	265	155	170	170	....	
24	215	180	605	1,280	3,867	2,520	1,240	265	155	170	170	....	
25	215	180	830	1,960	4,185	2,330	1,400	265	155	190	155	....	
26	215	170	1,440	1,610	4,130	2,235	1,320	235	155	190	155	....	
27	215	170	1,160	1,652	4,025	2,140	1,008	235	155	190	155	....	
28	215	170	1,200	1,825	4,460	2,050	900	235	145	520	155	....	
29	215	170	1,400	1,960	4,185	2,188	795	235	145	380	155	....	
30	215	....	1,240	2,330	3,815	2,095	695	235	145	380	155	....	
31	215	....	1,440	....	3,868	....	635	282	....	340	....	....	
Total	7,200	5,630	26,969	46,341	100,062	83,554	32,169	10,837	5,535	7,789	6,059	....	Period
Mean	232	194	870	1,545	3,228	2,785	1,038	350	184	251	202	....	991.5
Maximum	265	210	4,240	2,710	4,460	3,972	2,095	1,082	235	520	300	....	4,460
Minimum	215	170	160	635	1,780	1,738	635	222	145	155	155	....	155
Run-off per square mile	0.166	0.139	0.624	1.108	2.316	1.998	0.745	0.251	0.132	0.180	0.145	....	0.771
Run-off, depth, inches	0.191	0.150	0.719	1.236	2.670	2.229	0.859	0.289	0.147	0.208	0.162	....	8.860
Run-off, acre-feet	14,281	11,167	53,493	91,917	198,473	165,729	63,807	21,495	10,979	15,449	12,018	....	658,808
Acre-feet per square mile	10.24	8.01	38.37	65.94	142.38	118.88	45.77	15.42	7.87	11.08	8.62	....	472.58

NOTE.—Ice conditions Jan. 1-Mch. 11. Discharge estimated from measurements.

PIEDRA RIVER AT ARBOLES

This station is located on Denver & Rio Grande railroad bridge near Arboles and above the junction of the San Juan and Piedro rivers. This station was maintained by the State prior to October, 1912, since which time it has been maintained in co-operation with the State Engineer of New Mexico.

The equipment consists of a chain gauge fastened to lower chord of the railroad bridge.

The bed of the stream is composed of sand and gravel, and is liable to shift in high water.

The observer is L. E. Smack, who was paid $3.00 per month prior to October 1, after which his salary was $4.00 per month.

DISCHARGE MEASUREMENTS OF PIEDRA RIVER AT ARBOLES

DATE		HYDROGRAPHER	Area of Section Sq Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 21	Clayton & Turner	87	1.50	1.18	131
	Mar. 22	B. S. Clayton	229	3.67	2.90	843
	Apr. 23	B. S. Clayton	408	4.91	4.50	2,001
	May 25	B. S. Clayton	385	5.10	4.55	1,964
	Sept. 1	B. S. Clayton	150	2.13	1.95	320
	Nov. 16	B. S. Clayton	139	2.62	3.60	364
	Dec. 18*	B. S. Clayton	114	1.53		174
1912	Jan. 26*	B. S. Clayton	143	0.75		107
	Mar. 1	B. S. Clayton	84	1.15	2.59	97
	Apr. 12	B. S. Clayton	508	2.37	5.24	1,205
	May 10	C. C. Hezmalhalch	620	3.11	6.01	1,928
	June 12	C. C. Hezmalhalch	505	2.78	5.16	1,405
	July 18	C. C. Hezmalhalch	194	1.94	3.04	377
	Sept. 20	C. E. Turner	68	1.58	1.90	108
	Sept. 20	Gray & O'Brien	64	1.46	1.90	93
	Oct. 7	F. O'Brien	96	1.78	2.35	172
	Oct. 17	F. O'Brien	91	1.70	2.25	154
	Oct. 27	F. O'Brien	84	1.67	2.15	140

*Ice conditions.

DISCHARGE OF PIEDRA RIVER AT ARBOLES FOR 1911

Drainage Area, 650 Square Miles. Altitude, 6,001 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	91	100	175	130	2,082	1,240	1,932	2,275	572	345	490	425	330	
2	106	100	215	130	2,235	1,135	2,045	2,395	490	345	572	425	330	
3	86	100	200	175	2,120	1,415	2,158	2,008	465	305	1,240	405	330	
4	86	102	162	265	1,970	1,558	2,158	1,558	415	305	1,782	365	330	
5	86	102	150	465	2,315	2,008	2,235	1,558	390	285	9,370	365	295	
6	86	105	130	808	1,858	2,315	2,158	1,345	345	265	6,250	365	295	
7	96	105	122	490	2,195	2,635	2,045	1,275	345	265	2,570	365	295	
8	86	115	115	572	2,120	2,795	2,045	1,205	325	265	2,210	365	278	
9	91	115	105	655	2,008	2,955	2,082	1,002	305	230	855	348	260	
10	86	115	115	600	1,485	2,555	2,082	970	305	230	735	312	260	
11	86	175	130	970	1,415	2,315	2,008	1,345	305	200	855	312	242	
12	86	175	130	715	1,380	2,045	1,932	1,205	285	188	525	312	242	
13	86	345	115	685	1,415	1,858	1,932	1,632	265	175	525	312	225	
14	86	345	122	745	1,275	1,745	1,895	1,485	265	175	525	330	225	
15	86	345	130	745	1,345	1,782	1,820	1,520	248	200	525	295	225	
16	86	600	130	840	1,450	1,745	1,820	1,275	230	188	525	295	225	
17	86	572	140	905	1,632	1,820	1,932	1,135	200	175	485	385	160	
18	86	440	140	872	1,782	1,970	1,895	1,240	200	175	465	405	174	
19	86	440	150	840	1,708	2,082	1,520	1,670	200	175	465	405	174	
20	86	110	115	808	1,782	1,970	1,632	1,708	188	368	445	365	174	
21	91	105	105	745	1,858	1,595	1,670	1,858	175	285	445	365	174	
22	91	105	105	905	2,082	1,670	1,670	1,520	368	248	445	365	174	
23	96	100	115	840	2,158	1,745	1,745	1,240	775	248	525	348	160	
24	96	102	130	775	1,858	1,895	1,595	1,240	572	215	545	348	160	
25	86	105	115	840	1,820	2,008	1,485	1,310	518	200	545	330	160	
26	86	175	115	872	2,045	1,895	1,310	1,170	440	600	525	330	160	
27	86	162	110	808	2,082	1,782	1,310	1,170	775	345	565	365	150	
28	86	150	130	745	1,970	1,745	1,345	1,035	808	345	525	385	150	
29	86	115	....	1,035	1,932	1,745	1,275	905	808	1,275	545	445	150	
30	86	110	....	1,135	1,820	1,745	1,450	905	518	1,708	525	385	150	
31	86	115	....	1,450	....	1,782	....	655	345	....	465	....	150	
Total	2,736	5,950	3,716	22,565	55,197	59,550	54,181	42,814	12,445	10,328	37,069	10,822	6,807	Year 1911
Mean	88	192	133	728	1,840	1,921	1,806	1,381	401	344	1,196	361	220	881
Maximum	106	600	215	1,450	2,315	2,955	2,235	2,395	808	1,708	9,370	445	330	9,370
Minimum	86	100	105	130	1,275	1,135	1,275	655	175	175	445	295	150	100
Run-off per square mile	0.135	0.295	0.205	1.120	2.831	2.955	2.779	2.125	0.617	0.529	1.840	0.555	0.338	1.355
Run-off, depth, inches	0.156	0.340	0.213	1.291	3.158	3.407	3.100	2.450	0.711	0.590	2.121	0.620	0.390	18.393
Run-off, acre-feet	5,427	11,802	7,371	44,757	109,482	118,116	107,466	84,920	24,684	20,487	73,525	21,465	13,501	637,575
Acre-feet per square mile	8.35	18.16	11.34	68.86	168.44	181.72	165.33	130.65	37.98	31.52	113.12	33.02	21.77	980.88

NOTE.—Ice conditions Dec. 18-31, 1911. Discharge estimated from measurements. Discharge Oct. 5 and Oct. 6 approximate.

DISCHARGE OF PIEDRA RIVER AT ARBOLES FOR 1912

Drainage Area, 650 Square Miles. Altitude, 6,001 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	150	105	97	557	2,110	2,375	961	626	151	85	272	....	
2	150	105	95	602	2,165	2,407	859	604	151	85	256	....	
3	150	105	95	795	2,475	2,570	761	583	151	90	229	....	
4	150	105	90	920	1,760	2,472	647	497	151	120	229	....	
5	140	105	80	1,045	1,260	2,375	626	455	135	135	205	....	
6	140	105	70	1,330	1,760	2,407	518	415	135	142	193	....	
7	140	105	60	1,450	1,930	2,277	497	376	135	151	181	....	
8	140	105	58	2,002	2,045	2,310	455	287	120	151	181	....	
9	130	105	58	1,510	2,220	2,212	455	243	120	151	181	....	
10	130	100	970	1,510	2,115	1,920	376	193	120	151	181	....	
11	130	100	720	1,360	1,952	1,550	304	151	120	135	181	....	
12	130	100	300	1,330	2,115	1,370	287	127	120	112	181	....	
13	120	100	248	1,210	2,115	1,202	272	120	112	127	181	....	
14	120	100	157	1,098	2,017	1,148	272	272	106	127	160	....	
15	120	100	120	1,045	1,985	1,094	243	229	106	127	151	....	
16	120	100	107	920	2,017	1,121	229	160	106	127	151	....	
17	120	100	131	895	2,277	1,121	243	160	106	135	135	....	
18	110	100	107	895	2,570	1,061	272	135	106	142	135	....	
19	110	100	970	845	2,570	935	256	112	106	142	127	....	
20	110	100	845	820	2,635	884	376	112	100	142	135	....	
21	110	95	820	670	2,635	714	435	127	100	127	127	....	
22	110	95	580	625	2,667	737	358	127	85	127	120	....	
23	110	95	557	602	2,602	1,284	455	127	85	112	100	....	
24	110	95	535	895	2,537	1,256	647	135	85	112	95	....	
25	110	95	450	1,390	2,635	1,121	761	142	85	112	95	....	
26	105	95	745	1,240	2,635	1,067	1,229	170	85	112	90	....	
27	105	95	602	1,095	2,570	1,175	1,284	170	85	112	80	....	
28	105	95	625	1,310	2,570	1,040	1,175	151	85	256	85	....	
29	105	95	845	1,780	2,570	986	1,013	151	85	243	90	....	
30	105	....	670	2,000	2,602	935	692	170	85	321	90	....	
31	105	....	625	....	2,537	....	669	170	....	304	....	....	
Total	3,790	2,900	12,432	33,746	70,653	45,126	17,627	7,497	3,322	4,515	4,617	....	Period
Mean	122	100	401	1,125	2,279	1,504	569	242	111	146	154	....	616
Maximum	150	105	970	2,002	2,667	2,570	1,284	626	151	321	272	....	2,667
Minimum	105	95	58	557	1,260	714	229	112	85	85	80	....	58
Run-off per square mile	0.188	0.154	0.617	1.731	3.506	2.314	0.875	0.372	0.171	0.225	0.237	....	0.947
Run-off, depth, inches	0.217	0.166	0.711	1.931	4.042	2.581	1.009	0.429	0.191	0.259	0.264	....	11.800
Run-off, acre-feet	7,518	5,752	24,659	66,935	140,140	89,507	34,963	14,870	6,590	8,956	9,158	....	409,048
Acre-feet per square mile	11.57	8.85	37.94	102.98	215.60	137.69	53.79	22.88	10.14	13.78	14.09	....	609.31

NOTE.—Ice conditions Jan. 1-Mar. 7. Discharge estimated from measurements.

LOS PINOS RIVER AT IGNACIO

This station is located at wagon bridge near the Indian agency and one mile above Ignacio.

The equipment consists of a chain gauge located on the wagon bridge. Measurements are made from the bridge at high water and by wading at low water.

The bed of the stream is composed of gravel and boulders and shifts during high water.

The observer is Mrs. C. J. Werner, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF LOS PINOS RIVER AT IGNACIO

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 18	B. S. Clayton	56	1.95	2.22	110
	Mar. 21	B. S. Clayton	108	4.21	3.10	455
	Apr. 22	B. S. Clayton	196	5.47	4.00	1,073
	May 24	B. S. Clayton	280	7.10	4.80	1,990
	June 29	B. S. Clayton	242	4.63	4.35	1,120
	Sept. 1	B. S. Clayton	75	2.40	2.40	180
	Nov. 15	B. S. Clayton	159	1.71	....	272
	Dec. 16*	B. S. Clayton	178	0.94	....	167
1912	Jan. 27	B. S. Clayton	61	2.03	....	124
	Mar. 5	B. S. Clayton	68	1.94	1.09	132
	Apr. 13	B. S. Clayton	75	5.88	1.82	441
	May 10	C. C. Hezmalhalch	148	7.94	2.82	1,176
	June 13	C. C. Hezmalhalch	212	5.70	4.64	1,207
	July 19	C. C. Hezmalhalch	166	2.51	2.58	417
	Aug. 25	C. C. Hezmalhalch	56	1.49	1.16	83
	Sept. 20	C. E. Turner	37	1.12	0:81	41
	Oct. 20	C. E. Turner	65	1.85	1.39	120
	Nov. 18	C. E. Turner	49	2.78	1.55	136

*Ice conditions.

DISCHARGE OF LOS PINOS RIVER AT IGNACIO FOR 1911

Drainage Area, 450 Square Miles. Altitude, 6,481 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Period 1911
1	89	65	170	120	1,032	1,075	2,615	1,890	380	170	2,460	....	....	
2	89	65	120	130	1,075	1,165	2,690	2,310	360	170	1,825	....	....	
3	89	70	120	155	990	1,075	2,470	2,780	340	170	1,825	....	....	
4	89	70	140	140	1,032	1,032	2,690	2,235	320	225	1,760	....	....	
5	89	85	120	305	1,032	1,605	3,080	1,760	270	255	....	....	....	
6	89	85	120	372	950	2,192	3,245	1,472	210	225	....	....	....	
7	89	85	120	328	720	2,260	2,920	1,375	182	195	....	....	....	
8	89	85	110	350	755	2,330	2,920	1,240	120	182	....	....	....	
9	89	85	92	420	685	2,470	3,160	1,160	100	170	....	....	....	
10	97	92	85	530	620	2,615	3,500	1,122	92	170	....	....	....	
11	97	215	100	620	720	2,125	3,330	1,015	100	145	....	....	....	
12	89	248	100	500	652	1,855	2,920	1,050	85	145	....	....	....	
13	89	215	110	395	560	1,855	2,400	1,420	85	255	....	....	....	
14	89	170	110	350	620	1,545	2,690	1,955	85	285	....	....	....	
15	89	140	110	372	685	1,790	2,330	1,160	78	270	....	....	....	
16	97	110	110	285	720	1,855	2,400	1,122	70	225	....	....	....	
17	97	110	100	350	870	1,790	1,855	918	70	225	....	....	....	
18	97	185	100	372	830	1,922	1,855	982	70	195	....	....	....	
19	89	140	120	445	830	1,990	2,400	1,285	60	225	....	....	....	
20	81	120	120	500	1,120	1,725	1,605	1,122	70	255	....	....	....	
21	89	110	120	472	1,165	1,790	2,260	1,200	60	225	....	....	....	
22	89	110	120	560	1,165	1,605	2,840	1,015	255	210	....	....	....	
23	74	92	130	530	1,265	1,922	2,400	1,015	380	210	....	....	....	
24	75	92	130	472	1,320	1,855	2,160	1,330	340	255	....	....	....	
25	75	130	130	500	1,265	2,125	1,840	1,330	255	255	....	....	....	
26	75	185	130	472	1,320	2,125	1,380	1,122	182	445	....	....	....	
27	70	155	130	472	1,265	1,855	1,220	918	158	540	....	....	....	
28	70	130	130	530	1,320	1,790	1,420	885	170	445	....	....	....	
29	70	140	....	720	1,265	1,922	1,120	730	170	468	....	....	....	
30	70	130	....	620	1,320	1,605	1,200	515	145	1,160	....	....	....	
31	70	140	....	910	....	1,922	....	445	145	....	....	....	....	
Total	2,639	3,854	3,297	13,297	29,268	56,787	70,915	39,878	5,407	8,370	7,870	....	....	
Mean	85	124	118	429	976	1,832	2,364	1,286	174	279	1,968	....	....	863
Maximum	97	248	170	910	1,320	2,615	3,500	2,780	380	1,160	2,460	....	....	3,500
Minimum	70	65	85	120	560	1,032	1,120	445	60	145	1,760	....	....	60
Run-off per square mile	0.189	0.276	0.262	0.953	2.169	4.071	5.254	2.858	0.387	0.620	4.373	....	....	1.918
Run-off, depth, inches	0.218	0.318	0.273	1.099	2.420	4.693	5.862	3.296	0.446	0.692	0.650	....	....	19.758
Run-off, acre-feet	5,234	7,644	6,540	26,374	58,052	112,635	140,658	79,097	10,725	16,602	15,610	....	....	473,943
Acre-feet per square mile	11.63	16.98	14.53	58.61	129.00	250.30	312.60	175.80	23.83	36.90	34.69	....	....	1,053.20

NOTE.—Gauge washed out by flood Oct. 5.

DISCHARGE OF LOS PINOS RIVER AT IGNACIO FOR 1912

Drainage Area, 450 Square Miles. Altitude, 6,481 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	150	125	132	230	932	1,148	820	576	96	41	289	....	
2	150	125	132	250	1,065	1,236	668	540	96	58	289	....	
3	150	125	132	360	1,160	1,434	576	390	82	46	276	....	
4	150	125	132	482	932	1,500	558	276	69	52	276	....	
5	150	125	132	538	805	1,590	522	250	58	148	250	....	
6	150	125	192	538	768	1,280	488	237	52	104	237	....	
7	150	125	210	662	848	1,170	576	189	46	104	224	....	
8	140	125	173	730	1,160	1,258	540	158	46	138	224	....	
9	140	125	173	730	1,212	1,280	505	138	46	104	224	....	
10	140	120	482	805	1,065	1,258	540	96	46	75	224	....	
11	140	120	210	630	1,160	1,192	522	69	41	104	212	....	
12	140	120	137	568	1,440	1,236	522	58	36	69	200	....	
13	135	120	137	482	1,632	1,324	505	58	41	75	200	....	
14	135	120	105	456	1,265	1,214	522	112	46	69	200	....	
15	135	115	105	406	1,065	1,126	488	454	41	82	200	....	
16	135	115	155	456	1,160	880	454	454	41	89	189	....	
17	135	115	137	456	1,160	763	454	360	41	89	178	....	
18	130	115	137	456	840	725	438	438	36	104	178	....	
19	130	110	272	406	1,000	668	522	345	36	120	178	....	
20	130	110	510	382	980	649	522	302	32	138	178	....	
21	130	110	338	382	1,041	594	438	250	41	138	178	....	
22	130	110	294	338	1,104	649	540	178	41	148	178	....	
23	125	120	294	338	1,126	668	706	148	36	138	178	....	
24	125	120	250	510	1,126	744	471	158	36	120	168	....	
25	125	120	272	568	1,302	763	522	112	46	138	158	....	
26	125	120	294	510	1,302	744	576	89	41	138	158	....	
27	125	120	250	430	1,368	649	594	75	36	158	158	....	
28	125	130	250	382	1,390	612	594	69	46	330	158	....	
29	125	130	294	568	1,390	782	763	69	46	330	158	....	
30	125	....	294	730	1,434	940	649	69	46	302	138	....	
31	125	....	250	....	1,368	....	630	96	....	302	....	....	
Total	4,200	3,485	6,875	14,779	35,600	30,076	17,225	6,813	1,453	4,051	6,056	....	Period
Mean	136	120	222	493	1,148	1,002	556	220	48	131	202	....	390
Maximum	150	130	510	805	1,632	1,590	820	576	96	330	289	....	1,632
Minimum	125	110	105	230	768	594	438	58	32	41	138	....	32
Run-off per square mile	0.301	0.267	0.493	1.095	2.551	2.228	1.236	0.489	0.107	0.290	0.448	....	0.866
Run-off, depth, inches	0.347	0.288	0.568	1.222	2.941	2.486	1.425	0.564	0.120	0.334	0.500	....	10.795
Run-off, acre-feet	8,331	6,922	13,636	29,314	70,613	59,656	34,166	13,514	2,882	8,035	12,012	....	259,081
Acre-feet per square mile	18.51	15.38	30.30	65.14	156.90	132.55	75.92	30.03	6.40	17.86	26.69	....	575.68

NOTE.—Ice conditions Jan. 1-Mar. 4. Discharge estimated from measurements.

ANIMAS RIVER AT DURANGO

This station, formerly located at the Rio Grande Southern railroad bridge just below the mouth of Lightner creek, is now located opposite the substation of the San Juan Water & Power Company at Durango.

The equipment consists of a Bristol automatic gauge, a staff gauge and cable with car.

The bed of the stream is composed of gravel and boulders and is fairly permanent.

The observer in 1911 was Henry Schunk, who was paid $5.00 per month. In 1912 the observer was P. V. Sheridan, whose salary was $3.00 per month.

DISCHARGE MEASUREMENTS OF ANIMAS RIVER AT DURANGO

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 9	Grieve & Clayton	155	1.17	1.24	181
	Mar. 20	B. S. Clayton	211	2.59	2.35	547
	Apr. 21	B. S. Clayton	463	4.09	3.80	1,892
	May 23	B. S. Clayton	534	5.51	4.35	2,940
	June 27	B. S. Clayton	563	5.53	4.80	3,110
	Aug. 30	B. S. Clayton	319	1.74	3.30	556
	Nov. 15	B. S. Clayton	344	1.48	2.40	509
	Dec. 13	B. S. Clayton	218	1.33	....	290
1912	Jan. 28	B. S. Clayton	187	1.46	....	274
	Mar. 1	C. C. Hezmalhalch	126	1.85	1.09	233
	Apr. 17	B. S. Clayton	296	1.94	1.80	576
	May 12	C. C. Hezmalhalch	608	4.51	3.90	2,741
	May 31	H. B. Waha	869	6.14	5.30	5,340
	June 15	C. C. Hezmalhalch	465	3.64	3.20	1,680
	July 17	C. C. Hezmalhalch	482	3.55	3.22	1,713
	Sept. 21	C. E. Turner	221	1.42	1.38	312
	Nov. 19	C. E. Turner	219	1.33	1.36	292

DISCHARGE OF ANIMAS RIVER AT DURANGO FOR 1911

Drainage Area, 812 Square Miles. Altitude, 6,550 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	285	170	180	160	1,350	2,490	3,370	2,980	1,950	555	1,400	965	400	
2	285	170	180	160	1,350	2,490	3,370	2,980	1,725	555	2,130	965	400	
3	285	188	180	160	1,350	2,730	4,020	2,980	1,725	555	2,370	965	350	
4	285	228	180	180	1,350	2,730	4,020	2,980	1,400	555	2,910	965	350	
5	285	312	180	180	1,350	2,730	4,670	2,980	1,400	555	....	900	350	
6	285	350	180	195	1,350	2,730	4,670	2,980	1,400	555	11,000	900	350	
7	285	370	170	240	1,350	2,730	4,670	2,980	1,205	555	....	900	350	
8	285	370	160	295	1,350	2,730	4,670	2,980	1,205	555	5,830	800	300	
9	285	370	160	370	1,350	2,730	4,670	2,980	930	555	5,830	800	300	
10	285	370	160	370	1,350	2,730	4,670	2,980	930	555	5,830	800	290	
11	285	330	160	370	1,350	2,850	4,670	2,980	845	555	5,830	700	290	
12	285	280	160	370	1,350	2,850	4,670	3,110	765	555	4,540	600	290	
13	285	240	160	370	1,250	2,850	4,540	3,110	690	555	4,540	550	290	
14	285	215	160	520	1,250	2,850	4,540	3,110	690	555	5,450	550	290	
15	285	215	160	520	1,450	2,850	4,540	3,110	690	555	4,285	510	290	
16	285	215	160	520	1,450	2,850	4,540	3,240	690	555	3,955	510	290	
17	285	215	160	520	1,450	2,850	4,280	4,670	690	555	3,172	510	290	
18	285	215	160	520	1,560	3,180	4,280	4,670	690	555	2,240	510	290	
19	285	215	160	520	1,890	3,250	4,280	4,670	690	555	1,775	510	290	
20	265	195	160	520	2,010	3,310	3,890	4,670	690	555	1,345	510	290	
21	260	195	160	520	2,130	3,380	3,890	4,670	690	555	1,245	510	290	
22	250	195	160	520	2,130	3,450	3,370	4,290	690	555	1,245	450	290	
23	245	195	160	520	2,130	3,650	3,240	4,050	690	555	1,245	450	290	
24	235	180	160	520	2,130	3,600	3,240	3,680	690	555	1,245	450	290	
25	230	180	160	520	2,130	3,690	3,240	3,360	690	555	1,245	450	290	
26	225	180	160	520	2,490	4,290	3,240	2,730	555	620	1,245	450	290	
27	220	180	160	520	2,490	3,590	3,240	2,610	555	620	1,245	450	290	
28	215	180	160	520	2,490	3,540	2,980	2,430	555	620	1,150	400	290	
29	210	180	....	520	2,490	3,490	2,980	2,190	555	620	1,150	400	290	
30	190	180	....	1,350	2,490	3,430	2,980	2,190	555	930	1,150	400	290	
31	185	180	....	1,350	....	3,370	....	1,950	555	....	1,102	....	290	
Total	8,145	7,258	4,610	14,440	51,610	95,990	119,430	101,290	27,780	17,285	87,699	18,830	9,530	Period 1911
Mean	263	234	165	466	1,720	3,096	3,981	3,267	896	576	3,024	628	307	1,531
Maximum	285	370	180	1,350	2,490	4,290	4,670	4,670	1,950	930	11,000	965	400	11,000
Minimum	185	170	160	160	1,250	2,490	2,980	1,950	555	555	1,102	400	290	160
Run-off per square mile	0.324	0.288	0.203	0.574	2.119	3.813	4.952	4.023	1.104	0.710	3.724	0.785	0.378	1.885
Run-off, depth, inches	0.373	0.332	0.211	0.662	2.364	4.396	5.525	4.638	1.273	0.792	4.016	0.876	0.436	25.521
Run-off, acre-feet	16,155	14,396	9,144	28,642	102,368	190,396	236,889	200,909	55,102	34,285	173,951	37,350	18,903	1,102,335
Acre-feet per square mile	19.90	17.73	11.26	35.27	126.07	234.48	291.74	247.42	67.86	42.22	214.22	46.00	23.28	1,357.55

NOTE.—Discharge estimated Dec. 21, 1910-Feb. 28, 1911. Discharge Oct. 6, approximate.

DISCHARGE OF ANIMAS RIVER AT DURANGO FOR 1912

Drainage Area, 694 Square Miles. Altitude, 6,550 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	290	260	235	332	1,465	5,120	3,055	1,385	622	270	310	....	
2	290	260	235	355	1,675	5,340	2,445	1,295	525	270	310	....	
3	290	260	235	405	1,675	6,110	2,110	1,072	525	270	310	....	
4	290	260	240	460	1,275	6,660	1,695	990	495	270	310	....	
5	290	260	240	520	1,142	6,770	1,435	790	465	335	310	....	
6	280	260	240	520	1,100	5,340	1,295	720	465	335	310	....	
7	280	260	240	610	1,322	4,710	1,485	755	410	310	310	....	
8	280	250	240	820	1,842	4,810	1,865	720	410	310	310	....	
9	280	250	255	860	1,730	5,015	1,805	655	410	310	310	....	
10	280	250	332	1,060	1,465	4,310	1,865	590	410	310	310	....	
11	280	250	270	900	1,785	4,110	1,805	525	410	310	310	....	
12	280	250	270	820	2,570	3,055	1,750	525	410	310	310	....	
13	280	250	270	710	2,570	2,595	1,640	525	360	310	310	....	
14	280	250	290	640	2,020	2,240	1,750	622	360	290	310	....	
15	275	240	270	610	2,420	2,670	1,695	950	360	290	310	....	
16	275	240	270	580	2,570	2,670	1,585	910	360	290	270	....	
17	275	240	270	490	2,870	2,375	1,535	790	360	310	270	....	
18	275	240	270	520	4,015	1,925	1,435	830	310	310	270	....	
19	275	240	290	520	4,910	1,640	1,535	755	310	310	270	....	
20	275	240	355	520	5,450	1,695	1,750	720	310	310	270	....	
21	275	240	355	490	5,340	2,240	1,695	655	310	310	270	....	
22	275	240	355	460	5,780	2,520	1,535	590	310	310	270	....	
23	275	235	355	460	5,670	2,595	1,925	525	290	270	270	....	
24	275	235	310	550	5,670	2,745	1,695	525	270	270	250	....	
25	275	235	310	710	6,220	2,895	1,695	465	270	270	230	....	
26	275	235	355	710	6,550	3,215	1,750	465	270	270	230	....	
27	275	235	310	710	6,330	2,670	1,750	465	270	270	230	....	
28	275	235	310	780	6,220	2,445	1,485	465	270	360	230	....	
29	275	235	310	780	6,330	2,975	1,640	465	270	410	230	....	
30	275	....	332	1,020	6,990	3,385	1,865	495	270	360	200	....	
31	275	....	355	....	5,560	....	1,640	655	....	310	....	....	
Total	8,645	7,135	8,974	18,922	112,531	106,845	54,210	21,894	11,087	9,440	8,410	....	Period
Mean	279	246	289	631	3,630	3,562	1,749	706	370	305	280	....	1,099
Maximum	290	260	355	1,060	6,990	6,770	3,055	1,385	622	410	310	....	6,990
Minimum	275	235	235	332	1,100	1,640	1,295	465	270	270	200	....	200
Run-off per square mile	0.402	0.354	0.416	0.909	5.231	5.133	2.520	1.017	0.533	0.439	0.403	....	1.583
Run-off, depth, inches	0.463	0.381	0.480	1.014	6.031	5.727	2.905	1.172	0.594	0.506	0.450	....	19.723
Run-off, acre-feet	17,147	14,152	17,800	37,531	223,202	211,924	107,524	43,426	21,991	18,724	16,681	....	730,102
Acre-feet per square mile	24.71	20.39	25.65	54.08	321.62	305.36	154.93	62.57	31.69	26.98	24.04	....	1,052.02

NOTE.—Discharge estimated from measurements Jan. 1-Mar. 7.

FLORIDA RIVER NEAR DURANGO

This station is located at Cash's ranch about seven and one-half miles from Durango.

The equipment consists of a vertical staff gauge bolted to the down-stream corner of the left abutment of wagon bridge from which measurements are made at high water.

The bed of the stream is composed of large and small boulders and gravel, and shifts during high water.

The observer is Thos. Cash, whose salary is $4.00 per month.

DISCHARGE MEASUREMENTS OF FLORIDA RIVER NEAR DURANGO

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Apr. 21	B. S. Clayton	101	2.54	2.72	256
	May 22	B. S. Clayton	147	4.26	4.04	626
	June 27	B. S. Clayton	106	3.11	3.12	330
	Aug. 30	B. S. Clayton	38	1.39	1.68	52
	Dec. 15*	B. S. Clayton	27	1.00	2.25	27
1912	Jan. 28*	B. S. Clayton	13	0.95	1.90	12
	Mar. 1*	C. C. Hezmalhalch	13	1.00	....	13
	May 12	C. C. Hezmalhalch	136	2.66	3.70	362
	July 17	C. C. Hezmalhalch	56	1.46	3.13	82
	Sept. 21	C. E. Turner	25	0.82	2.47	21
	Oct. 20	C. E. Turner	42	0.83	2.70	35
	Nov. 19	C. E. Turner	36	0.69	2.52	25

*Ice conditions.

DISCHARGE OF FLORIDA RIVER NEAR DURANGO FOR 1911

Drainage Area, 136 Square Miles. Altitude, 6,550 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	29	23	20	23	226	226	746	474	178	46	727	....	....	
2	29	23	17	20	202	226	716	682	147	40	376	....	....	
3	22	23	17	20	178	238	716	667	128	46	232	....	....	
4	22	23	17	20	214	303	760	577	111	51	167	....	....	
5	25	23	20	20	178	399	804	431	111	51	....	....	....	
6	25	23	17	23	178	470	818	350	94	46	....	....	....	
7	29	23	17	20	167	499	774	460	78	40	....	....	....	
8	29	23	17	23	156	586	774	338	78	40	....	....	....	
9	29	23	17	23	135	615	818	290	78	64	....	....	....	
10	29	23	20	31	125	586	818	266	78	128	....	....	....	
11	19	23	20	46	135	528	818	210	78	46	....	....	....	
12	22	23	20	40	156	499	789	278	64	40	....	....	....	
13	22	20	20	46	146	499	687	390	78	51	....	....	....	
14	22	17	20	51	135	441	745	446	64	51	....	....	....	
15	22	17	20	51	146	385	695	376	58	58	....	....	....	
16	22	17	20	51	167	413	620	325	64	51	....	....	....	
17	20	20	20	64	214	528	516	278	51	46	....	....	....	
18	19	17	20	72	202	586	557	244	51	40	....	....	....	
19	22	13	20	80	214	658	600	376	64	40	....	....	....	
20	19	13	20	80	251	499	554	403	51	51	....	....	....	
21	22	17	20	80	277	456	668	431	51	40	....	....	....	
22	22	15	23	88	330	528	638	363	86	40	....	....	....	
23	19	17	23	80	330	644	562	376	78	51	....	....	....	
24	22	15	23	72	277	702	531	376	64	51	....	....	....	
25	22	17	23	80	251	644	500	637	64	46	....	....	....	
26	22	17	23	80	277	557	396	504	64	102	....	....	....	
27	22	15	23	80	303	528	376	403	64	120	....	....	....	
28	16	17	23	97	277	615	376	350	58	102	....	....	....	
29	16	17	....	135	290	644	376	278	51	128	....	....	....	
30	19	17	....	178	238	615	350	232	51	446	....	....	....	
31	22	17	....	190	....	644	....	210	46	....	....	....	....	
Total	701	591	560	1,964	6,375	15,761	19,098	12,021	2,381	2,152	1,502	....	....	Period 1911
Mean	23	19	20	63	213	508	637	388	77	72	376	....	....	225
Maximum	29	23	23	190	330	702	818	682	178	446	727	....	....	818
Minimum	16	15	17	20	125	226	350	210	46	40	167	....	....	17
Run-off per square mile	0.166	0.140	0.147	0.463	1.566	3.735	4.683	2.853	0.566	0.529	2.764	....	....	1.657
Run-off, depth, inches	0.191	0.162	0.153	0.537	1.743	4.310	5.222	3.287	0.651	0.588	0.411	....	....	17.064
Run-off, acre-feet	1,390	1,172	1,111	3,896	12,645	31,262	37,880	23,843	4,724	4,268	2,979	....	....	123,780
Acre-feet per square mile	10.22	8.62	8.17	28.65	92.95	229.88	278.55	175.33	34.74	31.38	21.90	....	....	910.15

NOTE.—Slight ice conditions during Jan. and Feb.

DISCHARGE OF FLORIDA RIVER NEAR DURANGO FOR 1912

Drainage Area, 136 Square Miles. Altitude, 6,550 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					280		202	115	55	15	36		
2					307		175	101	45	18	36		
3					280	539	158	87	45	18	36		
4					255	556	134	81	45	18	32		
5					221	458	127[a]	75	40	36	32		
6					221	428	120	65	40	28	28		
7					255	443	120	65	36	36	28		
8					314	428	120	55	28	36	28		
9					307	370	107	55	28	28	32		
10					280	342	107	50	36	36	32		
11					320	314	94	45	40	28	32		
12					390	232	94	45	36	32	32		
13					390	212	94	50	36	28	28		
14					348	202	94	87	28	28	28		
15					307	222	88	101	28	28	24		
16					348	222	83	94	28	28	24		
17					436	202	114	87	24	28	21		
18					514	166	87	101	21	32	21		
19					613	158	115	87	21	36	24		
20					613	166	108	75	18	36	28		
21				122	648	166	87	70	15	36	21		
22				122	648	184	108	65	15	28	24		
23				130		184	247	55	15	32	28		
24				154		166	203	55	15	36	24		
25				171		193	165	55	15	28	28		
26				162		184	156	45	15	28	45		
27				162		175	156	45	15	36	45		
28				171		175	147	45	15	60	36		
29				200		242	165	45	15	40	28		
30				244		264	147	45	15	50	28		
31							131	65		40			
Total				1,638	8,295	7,593	4,053	2,111	828	987	889		Period
Mean				164	377	271	131	68	28	32	30		124
Maximum				244	648	556	247	115	55	60	45		648
Minimum				122	221	158	83	45	15	15	21		15
Run-off per square mile				1.204	2.772	1.992	0.961	0.500	0.204	0.235	0.221		0.912
Run-off, depth, inches				0.448	2.268	2.074	1.110	0.576	0.227	0.271	0.247		7.221
Run-off, acre-feet				3,249	16,453	15,060	8,039	4,187	1,642	1,958	1,763		52,351
Acre-feet per square mile				23.89	120.98	110.74	59.11	30.79	12.07	14.40	12.96		384.94

NOTE.—Observer unable to get to gauge from May 22 to June 2.

WEST MANCOS RIVER NEAR MANCOS

This station is located at Crane's ranch about four miles above the town of Mancos.

The only equipment consists of a staff gauge bolted to a tree. Measurements are made by wading

The bed of the stream is composed of large and small boulders, and changes in floods.

This station was discontinued after the high water of October, 1911.

The observer was W. H. Crane, whose salary was $3.00 per month.

DISCHARGE MEASUREMENTS OF WEST MANCOS RIVER NEAR MANCOS

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Mar. 19	B. S. Clayton	14	2.45	0.93	31
Apr. 19	B. S. Clayton	27	3.88	1.39	103
May 22	B. S. Clayton	30	4.43	1.58	133
June 25	B. S. Clayton	29	3.17	1.48	92
Aug. 28	B. S. Clayton	14	2.00	1.16	28

DISCHARGE OF WEST MANCOS RIVER NEAR MANCOS FOR 1911
Drainage Area, 46 Square Miles. Altitude, 7,000 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	10.2				63	197	143	86	96	13				
2	10.2				63	197	169	86	77	13				
3	10.2				63	211	169	86	77	13				
4	10.2				56	211	169	86	52	13				
5	10.2				56	225	197	86	35	11				
6	10.2				63	225	197	77	39	11				
7	8.7				63	253	197	77	35	11				
8	8.7				48	253	197	77	35	11				
9	8.7				48	253	197	77	35	11				
10	8.7				48	225	197	77	39	11				
11	8.7				48	211	197	77	35	11				
12	8.7				48	211	197	118	31	9				
13	8.7				56	211	197	96	31	9				
14	8.7				63	211	197	96	31	9				
15	8.7				63	211	211	86	31	9				
16	8.7				72	211	225	86	31	9				
17	8.7				80	211	197	86	31	9				
18	8.7				90	197	183	86	31	9				
19	8.7				99	197	156	153	31	9				
20	8.7				120	169	156	142	31	9				
21	8.7				120	169	143	142	31	9				
22	8.7				143	156	143	118	31	9				
23	8.7				143	156	120	107	24	9				
24	8.7				143	156	99	96	24	9				
25	8.7				143	156	99	252	24	9				
26	8.7				143	143	99	196	24	9				
27	8.7				156	143	96	168	28	13				
28	8.7				156	143	96	96	24	16				
29	8.7				169	143	96	224	24	18				
30	8.7				169	143	86	142	24	114				
31	8.7					156		118	24					
Total	278.7				2,795	5,954	4,825	3,500	1,116	425				Period 1911
Mean	9.0				93	192	161	113	36	14				102
Maximum	10.2				169	253	225	252	96	114				253
Minimum	8.7				48	143	86	77	24	9				9
Run-off per square mile	0.196				2.022	4.174	3.500	2.457	0.783	0.304				2.211
Run-off, depth, inches	0.226				2.256	4.812	3.905	2.833	0.903	0.339				15.048
Run-off, acre-feet	553				5,544	11,810	9,570	6,942	2,214	843				36,923
Acre-feet per square mile	12.02				120.52	256.74	208.04	150.91	48.13	18.33				802.67

DOLORES RIVER AT DOLORES

This station is located about one-fourth mile southwest of railroad station at Dolores.

During 1911 the equipment, consisting of an automatic gauge and staff gauge, was lost in the high water of October. In 1912 a chain gauge replaced the old gauge at the same datum.

The observer at this station is Mrs. J. R. Hughes, whose salary is $4.00 per month.

DISCHARGE MEASUREMENTS OF DOLORES RIVER AT DOLORES

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 11*	Clayton & Grieve	53	1.24	2.38	66
	Feb. 12*	Clayton & Grieve	52	1.33	2.40	69
	Mar. 17	B. S. Clayton	83	2.56	2.92	212
	Apr. 17	B. S. Clayton	212	4.22	4.00	888
	May 18	B. S. Clayton	355	6.03	5.30	2,140
	May 19	B. S. Clayton	393	6.84	5.70	2,690
	June 25	B. S. Clayton	277	4.88	4.75	1,350
	Aug. 28	B. S. Clayton	114	2.10	2.95	240
	Nov. 12	B. S. Clayton	113	1.33	2.69	150
	Dec. 12*	B. S. Clayton	98	0.90	2.92	88
1912	Jan 30*	B. S. Clayton	87	0.88	....	77
	Mar. 11*	B. S. Clayton	38	2.24	3.05	85
	Apr. 18	B. S. Clayton	155	2.14	3.29	332
	May 13	C. C. Hezmalhalch	422	6.11	5.80	2,575
	June 14	C. C. Hezmalhalch	339	4.35	4.60	1,476
	July 20	C. C. Hezmalhalch	196	2.48	3.50	487
	Sept. 22	C. E. Turner	42	1.77	2.62	75
	Oct. 22	C. E. Turner	58	1.95	2.72	113
	Nov. 20	C. E. Turner	43	1.63	2.50	70

*Ice conditions.

DISCHARGE OF DOLORES RIVER AT DOLORES FOR 1911

Drainage Area, 524 Square Miles. Altitude, 6,945 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	93	80	65	74	805	1,390	2,008	895	695	180	....	....	100	
2	102	80	65	74	848	1,440	1,902	1,042	605	180	....	....	100	
3	102	80	65	67	805	1,692	1,902	1,042	545	180	....	....	100	
4	93	80	65	74	805	2,008	1,955	930	515	195	....	....	100	
5	55	80	65	92	692	2,452	2,008	795	485	180	....	....	100	
6	69	80	65	92	655	2,740	2,115	762	430	150	....	....	100	
7	93	80	65	82	618	2,682	2,008	968	380	150	....	....	90	
8	84	80	65	92	580	2,798	2,008	930	358	150	....	....	90	
9	84	80	65	102	548	2,855	2,225	828	335	150	....	....	90	
10	93	75	65	195	548	2,740	2,170	695	358	137	....	....	90	
11	84	75	65	340	618	2,395	2,060	605	405	124	....	....	90	
12	69	75	70	210	655	2,280	1,955	635	405	124	....	150	88	
13	55	75	74	165	618	2,280	1,850	1,005	380	137	....	150	88	
14	84	75	74	150	618	2,060	1,955	1,230	312	150	....	150	88	
15	84	75	74	165	655	2,060	1,955	1,042	270	165	....	140	88	
16	84	70	67	195	768	2,008	1,770	860	270	150	....	160	88	
17	84	70	67	230	890	2,115	1,540	860	270	124	....	150	88	
18	84	70	82	250	975	2,225	1,420	730	250	113	....	150	88	
19	84	70	74	230	1,105	2,510	1,350	1,155	270	102	....	160	85	
20	93	70	67	272	1,292	2,060	1,380	1,470	250	82	....	150	85	
21	90	60	67	295	1,440	1,745	1,300	1,350	250	92	....	125	85	
22	90	60	113	340	1,745	1,798	1,380	1,230	335	124	....	125	85	
23	90	60	74	368	1,798	2,060	1,220	1,192	358	230	....	125	85	
24	90	60	82	395	1,540	2,280	1,200	1,080	290	195	....	125	85	
25	90	60	102	425	1,540	2,280	1,120	1,350	250	137	....	125	85	
26	85	60	82	340	1,745	2,225	1,005	1,840	250	102	....	125	85	
27	85	60	82	290	1,850	2,115	968	1,470	210	210	....	125	85	
28	85	60	74	340	2,008	2,060	1,005	1,350	210	270	....	125	85	
29	85	60	....	425	2,060	2,008	930	1,155	195	405	....	125	85	
30	85	60	....	548	1,590	1,850	895	1,042	180	1,042	....	125	85	
31	85	60	....	692	....	1,850	....	795	180	....	....	....	85	
Total	2,548	2,180	2,040	7,609	32,414	67,061	48,559	32,333	10,496	5,730	....	2,610	2,771	Period 1911
Mean	82	70	73	245	1,080	2,163	1,619	1,043	339	191	....	137	89	662
Maximum	102	80	113	692	2,060	2,855	2,225	1,840	695	1,042	....	160	100	2,855
Minimum	55	60	65	67	548	1,390	895	605	180	82	....	125	85	60
Run-off per square mile	0.156	0.134	0.139	0.468	2.061	4.109	3.090	1.990	0.647	0.364	....	0.262	0.170	1.263
Run-off, depth, inches	0.180	0.154	0.145	0.540	2.299	4.831	3.448	2.294	0.746	0.406	....	0.185	0.196	15.171
Run-off, acre-feet	5,054	4,324	4,046	15,092	64,292	133,014	96,315	64,131	20,818	11,364	....	5,177	5,496	424,078
Acre-feet per square mile	9.65	8.25	7.72	28.80	122.67	253.80	183.78	122.37	39.72	21.69	....	9.88	10.49	809.40

NOTE.—Ice conditions Dec. 22-31, 1910; Jan. 1-Feb. 12, Nov. 12-Dec. 31, 1911. Discharge estimated from measurements. Gauge out Oct. 1-Nov. 11.

DISCHARGE OF DOLORES RIVER AT DOLORES FOR 1912

Drainage Area, 524 Square Miles. Altitude, 6,945 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	85	75	80	260	1,100	2,430	1,260	740	740	70	450	....	
2	85	75	80	260	1,610	2,300	915	550	260	70	35	....	
3	85	75	80	305	1,610	2,300	780	390	50	85	210	....	
4	85	75	80	340	1,200	2,495	780	420	170	100	50	....	
5	85	75	85	340	1,010	2,495	620	360	118	210	135	....	
6	85	75	85	340	930	2,365	620	335	118	135	135	....	
7	85	75	85	340	1,300	2,180	585	285	100	100	118	....	
8	85	70	85	425	2,190	2,240	515	260	85	100	50	....	
9	85	70	85	705	2,190	2,240	550	235	100	100	152	....	
10	85	70	85	742	1,500	2,300	550	235	100	100	190	....	
11	85	70	85	640	1,610	2,180	515	210	100	118	190	....	
12	85	70	100	640	2,440	1,820	480	210	85	118	135	....	
13	80	70	125	425	2,830	1,360	480	210	85	135	100	....	
14	80	70	150	425	1,950	1,160	620	210	70	100	118	....	
15	80	70	175	340	2,190	1,580	1,580	390	100	118	35	....	
16	80	70	200	425	2,970	1,210	1,210	285	100	118	118	....	
17	80	70	245	425	3,150	1,360	780	335	135	100	70	....	
18	80	70	245	340	3,330	1,160	700	285	70	100	85	....	
19	80	75	245	305	3,440	915	480	285	70	118	70	....	
20	80	75	245	305	3,530	1,010	480	210	70	118	45	....	
21	80	75	245	305	3,700	1,060	420	235	70	100	50	....	
22	80	75	245	305	3,790	1,160	390	170	70	100	70	....	
23	80	75	245	290	3,470	1,260	420	152	70	118	100	....	
24	80	75	245	448	3,780	1,360	480	152	70	100	135	....	
25	80	75	305	575	3,520	1,310	1,010	135	70	100	70	....	
26	75	75	340	520	3,420	1,210	550	152	70	100	100	....	
27	75	75	340	520	3,150	1,310	550	70	70	100	45	....	
28	75	80	305	520	3,020	1,310	740	152	70	285	50	....	
29	75	80	305	855	3,200	1,760	740	170	85	210	50	....	
30	75	....	305	855	3,370	1,470	700	335	85	170	50	....	
31	75	....	305	....	2,960	....	740	285	....	335	....	....	
Total	2,510	2,130	5,830	13,520	79,460	50,310	21,240	8,448	3,456	3,931	3,211	....	Period
Mean	81	73	188	451	2,563	1,677	685	272	115	127	107	....	579
Maximum	85	80	340	855	3,790	2,495	1,260	740	740	335	450	....	3,790
Minimum	75	70	80	260	1,100	915	390	70	70	70	35	....	35
Run-off per square mile	0.154	0.140	0.359	0.860	4.892	3.200	1.307	0.520	0.220	0.242	0.204	....	1.105
Run-off, depth, inches	0.177	0.151	0.414	0.960	5.641	3.570	1.507	0.600	0.245	0.279	0.228	....	13.770
Run-off, acre-feet	4,982	4,228	11,572	26,837	157,728	99,865	42,161	16,769	6,860	7,797	6,369	....	384,890
Acre-feet per square mile	9.51	8.07	22.08	51.22	301.01	190.58	80.46	32.00	13.09	14.88	12.15	....	734.62

NOTE.—Ice conditions Jan. 1-Mar. 16. Discharge estimated from measurements.

SAN MIGUEL RIVER AT PLACERVILLE

This station is located about three-fourths mile below Placerville, just below the mouth of Leopard creek.

The equipment consists of a slope gauge bolted to left abutment of wagon bridge from which measurements are made during high water.

The bed of the stream is composed of coarse gravel and boulders and is permanent.

The observer is John E. Stanquist, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF SAN MIGUEL RIVER AT PLACERVILLE

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 13*	Clayton & Grieve			0.40	61
	Mar. 16	B. S. Clayton	36	2.02	0.48	72
	Apr. 15	B. S. Clayton	56	2.96	1.00	166
	May 20	B. S. Clayton	92	5.50	2.10	513
	June 24	B. S. Clayton	102	6.21	2.50	634
	Aug. 26	B. S. Clayton	78	3.12	1.40	243
	Oct. 5†	B. S. Clayton	200	11.90	5.20	2,380
	Nov. 24	B. S. Clayton	43	2.18	0.67	94
	Dec. 16‡	M. E. Bunger	62	0.90	1.70	56
1912	Jan. 31	B. S. Clayton	39	2.10	0.60	82
	Mar. 17	B. S. Clayton	29	2.00	0.38	58
	Apr. 20	B. S. Clayton	48	2.52	0.83	121
	May 15	C. C. Hezmalhalch	113	5.90	2.48	668
	July 22	C. C. Hezmalhalch	124	5.05	2.40	625
	Aug. 28	C. C. Hezmalhalch	69	2.77	1.08	191
	Sept. 23	C. E. Turner	45	2.75	0.85	124
	Oct. 23	C. E. Turner	46	2.04	0.65	94
	Nov. 22	C. E. Turner	37	1.70	0.42	63

*Made above Leopard creek, but flow is included. †By floats 85% of surface velocity. ‡Ice conditions.

DISCHARGE OF SAN MIGUEL RIVER AT PLACERVILLE FOR 1911

Drainage Area, 304 Square Miles. Altitude, 7,309 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	88	75	91	68	184	322	635	680	....	181	1,010	141	85	
2	80	75	83	68	184	306	615	885	....	170	658	150	85	
3	72	75	68	60	209	370	632	815	....	181	470	132	85	
4	80	75	68	68	209	472	695	860	....	181	330	132	80	
5	72	60	75	75	160	529	780	748	....	170	1,602	150	80	
6	80	91	75	68	160	606	890	725	....	150	1,350	141	80	
7	88	127	60	68	148	626	820	748	....	150	792	132	75	
8	80	108	60	68	138	666	885	680	....	150	570	150	75	
9	80	91	60	68	138	706	910	680	346	141	490	150	75	
10	80	91	68	108	127	686	860	612	362	150	432	150	70	
11	88	91	68	91	138	646	910	530	379	150	396	115	70	
12	80	75	68	68	138	586	908	510	379	150	346	100	70	
13	80	75	68	75	127	586	858	815	379	160	330	160	60	
14	65	75	60	75	118	548	906	....	330	181	300	132	60	
15	65	75	60	75	127	529	788	....	315	181	285	132	60	
16	65	91	54	75	160	510	662	....	315	170	256	132	56	
17	65	75	54	75	199	529	620	....	315	150	256	132	55	
18	58	75	60	68	222	548	600	....	285	141	229	132	55	
19	65	75	60	68	276	666	658	....	285	132	216	132	55	
20	65	75	60	75	338	510	678	....	285	132	181	124	55	
21	65	75	54	83	404	510	700	....	330	124	170	124	50	
22	80	75	60	83	387	510	760	....	451	124	181	124	50	
23	65	68	60	83	354	510	700	....	362	160	181	115	50	
24	65	68	60	83	370	586	700	....	330	132	181	108	50	
25	58	68	68	83	370	626	635	....	285	124	170	100	50	
26	58	68	68	68	370	626	635	....	270	150	181	108	55	
27	72	68	54	83	438	548	680	....	229	192	170	100	55	
28	58	68	60	100	404	562	770	....	216	256	170	85	55	
29	65	83	....	108	404	580	725	....	204	242	181	92	55	
30	80	83	....	127	338	638	702	....	192	570	150	92	55	
31	80	68	....	148	....	615	....	....	181	....	141	....	55	
Total	2,372	2,442	1,804	2,513	7,339	17,258	22,317	9,288	7,025	5,245	12,375	3,767	1,966	Period 1911
Mean	76	79	64	81	245	557	744	714	305	175	399	126	63	275
Maximum	88	127	91	148	438	706	910	860	451	570	1,602	160	85	1,602
Minimum	58	60	54	60	118	306	600	510	181	124	141	85	50	54
Run-off per square mile	0.252	0.260	0.210	0.267	0.806	1.832	2.447	2.349	1.003	0.576	1.313	0.413	0.207	0.905
Run-off, depth, inches	0.290	0.300	0.219	0.308	0.900	2.112	2.730	1.136	0.858	0.642	1.514	0.461	0.239	11.419
Run-off; acre-feet	4,705	4,844	3,578	4,984	14,557	34,231	44,265	18,422	13,934	10,403	24,545	7,472	3,900	185,135
Acre-feet per square mile	15.38	15.93	11.77	16.39	47.88	112.60	145.67	60.60	45.83	34.22	80.74	24.58	12.83	609.00

NOTE.—Ice conditions Jan. 1-3, Nov. 30-Dec. 31, 1911. Discharge estimated from measurements. Gauge washed out Aug. 14.

DISCHARGE OF SAN MIGUEL RIVER AT PLACERVILLE FOR 1912

Drainage Area, 304 Square Miles. Altitude, 7,309 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	55	92	78	78	447	1,215	935	447	212	100	85	....	
2	55	162	66	85	561	1,380	786	396	174	100	85	....	
3	55	174	72	100	540	1,530	716	362	162	100	100	....	
4	55	140	72	120	483	1,500	624	345	162	100	92	....	
5	55	110	72	130	447	1,380	502	312	162	130	100	....	
6	55	72	66	140	561	1,215	483	296	140	120	92	....	
7	55	78	66	140	716	1,160	624	252	151	120	92	....	
8	55	78	72	174	810	1,188	624	252	140	120	85	....	
9	55	78	72	225	739	1,215	624	238	130	100	92	....	
10	55	72	72	199	693	1,188	624	238	140	120	85	....	
11	60	66	66	199	860	1,085	624	225	130	100	100	....	
12	60	72	66	174	910	935	603	225	120	92	92	....	
13	60	78	60	151	762	810	624	225	120	92	92	....	
14	60	78	60	140	693	693	670	252	140	100	92	....	
15	60	72	72	130	960	693	582	281	140	110	92	....	
16	60	72	60	130	1,110	786	521	281	140	100	85	....	
17	70	72	60	130	1,135	739	521	281	140	100	85	....	
18	70	72	72	110	1,242	670	483	312	130	100	85	....	
19	70	66	78	120	1,188	582	603	266	120	100	85	....	
20	70	66	85	130	1,188	647	647	238	120	110	78	....	
21	80	60	72	110	1,160	716	603	212	120	100	85	....	
22	80	66	78	110	1,188	810	582	199	120	92	78	....	
23	80	66	72	110	1,188	810	624	186	120	100	78	....	
24	80	66	72	140	1,242	860	502	174	120	100	78	....	
25	90	72	85	199	1,380	885	693	174	120	92	60	....	
26	100	72	92	151	1,352	910	582	174	120	92	60	....	
27	100	72	78	199	1,298	860	521	174	120	100	60	....	
28	100	72	85	225	1,270	810	483	174	100	151	66	....	
29	92	72	85	252	1,380	910	502	162	100	110	66	....	
30	85	....	85	328	1,500	1,010	603	199	100	110	66	....	
31	100	....	85	....	1,270	....	561	281	....	100	....	....	
Total	2,177	2,388	2,276	4,629	30,273	29,192	18,676	7,833	4,013	3,261	2,491	....	Period
Mean	70	82	73	154	977	973	602	253	134	105	83	....	320
Maximum	100	174	92	328	1,500	1,530	935	447	212	151	100	....	1,530
Minimum	55	66	60	78	447	582	483	162	100	92	60	....	55
Run-off per square mile	0.230	0.270	0.240	0.507	3.214	3.200	1.980	0.832	0.441	0.345	0.273	....	1.053
Run-off, depth, inches	0.265	0.291	0.277	0.566	3.705	3.570	2.283	0.959	0.492	0.398	0.304	....	13.110
Run-off, acre-feet	4,318	4,736	4,514	9,182	60,046	57,902	37,044	15,537	7,960	6,468	4,941	....	212,648
Acre-feet per square mile	14.20	15.58	14.85	30.21	197.50	190.46	121.85	51.11	26.18	21.28	16.25	....	699.47

NOTE.—Ice conditions Jan. 1-26. Discharge estimated from measurements.

Yampa and White Rivers Drainage

YAMPA RIVER AT YAMPA

This station was established in 1910 by the State, and is located on the upper road bridge between the railroad depot and town.

The equipment consists of a staff gauge located on bridge pier.

The channel is composed of cobblestones, and shifts during high stages.

The observer is C. L. Arnold, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF YAMPA RIVER AT YAMPA

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 23*	C. L. Chatfield	....	....	2.30	20
Feb. 25*	C. L. Chatfield	17	0.94	2.20	16
May 17†	C. L. Chatfield	20	2.60	{ 1.73‡ 1.20 }	52
June 13	C. L. Chatfield	25	4.16	{ 2.18‡ 1.60 }	104
July 16	C. L. Chatfield	6	1.26	{ 1.23‡ 0.70 }	9
Aug. 5	C. L. Chatfield	2	0.60	0.45	1
Sept. 14	C. L. Chatfield	7	1.28	0.78	8
Oct. 29	C. L. Chatfield	11	2.00	1.05	22
1912 Feb. 20*	C. L. Chatfield	25	0.76	....	19
Apr. 8	C. L. Chatfield	17	1.47	1.15	25
May 16	C. L. Chatfield	17	1.29	1.03	22
July 4	C. L. Chatfield	21	6.00	1.30	126

*Ice conditions. †New gauge put in. ‡Old gauge heights.

DISCHARGE OF YAMPA RIVER AT YAMPA FOR 1911

Drainage Area, 52 Square Miles. Altitude, 7,884 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1								35	7	22	12	26		
2								46	7	22	12	26		
3								35	7	18	12	22		
4								59	7	18	18	22		
5								46	7	18	26	30		
6								35	7	18	26	30		
7								26	7	15	18	30		
8								30	7	15	18	26		
9								35	10	15	18	30		
10								26	10	15	12	30		
11								26	18	15	12	30		
12								35	30	12	12	30		
13								30	35	12	12	30		
14								22	22	12	12	30		
15								15	26	12	12	30		
16								18	26	12	10	30		
17								30	26	15	12			
18								35	22	18	12			
19								40	22	18	7			
20								26	26	18	10			
21								35	35	18	22			
22								30	35	12	40			
23								18	46	12	59			
24								12	35	12	52			
25								12	30	12	35			
26								15	26	15	35			
27								10	26	15	30			
28								7	26	18	30			
29								4	26	18	26			
30								4	26	18	26			
31								12	22	......	26			
Total								809	662	470	664	452		Period 1911
Mean								26	21	16	21	28		22
Maximum								59	46	22	59	30		59
Minimum								4	7	12	7	22		4
Run-off per square mile								0.500	0.404	0.308	0.404	0.538		0.423
Run-off, depth, inches								0.576	0.466	0.344	0.466	0.320		2.171
Run-off, acre-feet								1,605	1,313	932	1,317	897		6,064
Acre-feet per square mile								30.82	25.25	17.92	25.33	17.25		116.57

DISCHARGE OF YAMPA RIVER AT YAMPA FOR 1912

Drainage Area, 52 Square Miles. Altitude, 7,884 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	25	68	192	179	26	31	31	....	
2	....	....	....	....	20	156	179	192	26	31	31	....	
3	....	....	....	....	35	167	142	154	22	31	31	....	
4	....	....	....	....	52	259	130	154	22	31	31	....	
5	....	....	....	....	30	259	179	130	22	31	31	....	
6	....	....	....	....	30	320	192	142	22	31	31	....	
7	....	....	....	30	30	395	218	130	18	31	31	....	
8	....	....	....	30	40	410	154	120	14	31	31	....	
9	....	....	....	20	35	395	130	109	14	31	31	....	
10	....	....	....	16	25	365	100	109	22	31	31	....	
11	....	....	....	20	20	325	82	73	22	26	31	....	
12	....	....	....	25	25	205	91	58	22	26	31	....	
13	....	....	....	16	20	150	91	43	31	22	31	....	
14	....	....	....	20	16	128	109	43	31	22	31	....	
15	....	....	....	20	16	108	109	58	43	22	31	....	
16	....	....	....	16	16	73	91	43	43	26	31	....	
17	....	....	....	16	25	58	109	43	43	26	26	....	
18	....	....	....	20	46	50	109	31	43	26	26	....	
19	....	....	....	16	40	43	82	31	43	26	26	....	
20	....	....	....	20	68	43	109	31	31	31	26	....	
21	....	....	....	25	93	58	109	31	31	31	26	....	
22	....	....	....	25	68	73	109	31	31	31	26	....	
23	....	....	....	20	68	73	100	31	31	31	26	....	
24	....	....	....	20	115	82	66	31	31	31	26	....	
25	....	....	....	25	107	91	109	31	22	31	26	....	
26	....	....	....	25	93	166	100	26	22	31	26	....	
27	....	....	....	20	74	260	120	22	31	31	26	....	
28	....	....	....	25	62	464	205	22	31	31	22	....	
29	....	....	....	20	86	232	205	31	31	31	22	....	
30	....	....	....	25	57	352	205	31	31	31	22	....	
31	....	....	....	....	123	....	154	31	....	31	....	....	
Total	....	....	....	515	1,560	5,828	4,080	2,191	852	904	848	....	Period
Mean	....	....	....	21	50	194	132	71	28	29	28	....	70
Maximum	....	....	....	30	123	464	218	192	43	31	31	....	464
Minimum	....	....	....	16	16	43	66	22	14	22	22	....	14
Run-off per square mile	....	....	....	0.438	0.962	3.731	2.538	1.365	0.538	0.558	0.538	....	1.346
Run-off, depth, inches	....	....	....	0.391	1.109	4.163	2.926	1.574	0.600	0.643	0.600	....	12.006
Run-off, acre-feet	....	....	....	1,021	3,094	11,560	8,093	4,346	1,690	1,793	1,682	....	332.79
Acre-feet per square mile	....	....	....	19.63	59.51	222.31	155.47	83.58	32.50	34.48	32.35	....	639.83

YAMPA RIVER AT STEAMBOAT SPRINGS

This station, established by the United States Geological Survey in 1904, is now maintained by the State and is located on a steel bridge between the railroad depot and town.

The equipment consists of a Bristol automatic gauge and standard chain gauge.

The bed of the stream is composed of cobbles and is permanent.

The channel at this station is kept open in winter by water from hot sulphur springs above.

The observer is K. Nakagawa, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF YAMPA RIVER AT STEAMBOAT SPRINGS

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	May 15	C. L. Chatfield	385	5.48	4.00	2,112
	May 22	C. L. Chatfield	285	3.92	3.10	1,132
	June 10	C. L. Chatfield	342	5.42	3.62	1,853
	June 20	Chatfield & Bowers	314	4.72	3.35	1,482
	July 18	C. L. Chatfield	142	1.71	1.55	243
	July 26	Chatfield & Maxwell	122	1.41	1.35	172
	Aug. 29	Ault & Chatfield	94	0.82	1.00	77
	Sept. 13	C. L. Chatfield	94	0.70	1.00	66
	Oct. 31	C. L. Chatfield	80	1.11	1.13	89
1912	Feb. 17	C. L. Chatfield	88	1.12	1.20	98
	Feb. 23	C. L. Chatfield	85	1.07	1.11	91
	Apr. 6	C. L. Chatfield	148	1.91	1.80	282
	Apr. 9	C. L. Chatfield	188	2.48	2.15	467
	Apr. 10	C. L. Chatfield	218	2.67	2.28	582
	May 12	C. L. Chatfield	296	3.92	2.98	1,160
	June 19	C. L. Chatfield	305	4.44	3.25	1,355
	June 27	C. L. Chatfield	383	6.00	4.08	2,298
	July 22	C. L. Chatfield	196	2.73	3.19	535
	Aug. 21	C. L. Chatfield	109	1.72	1.38	187

DISCHARGE OF YAMPA RIVER AT STEAMBOAT SPRINGS FOR 1911

Drainage Area, 572 Square Miles. Altitude, 6,680 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	130	73	93	105	380	680	2,635	430	130	80	250	102	....	
2	130	73	93	115	405	680	2,635	380	145	102	162	102	....	
3	130	73	93	115	430	680	2,478	380	115	90	215	115	....	
4	105	73	93	115	458	680	2,478	380	115	130	180	102	....	
5	83	73	93	115	485	720	2,530	430	90	145	545	180	....	
6	65	73	93	115	485	760	2,530	330	80	115	545	130	....	
7	83	73	93	115	485	800	2,425	515	70	70	380	130	....	
8	73	73	93	115	458	840	2,640	485	70	80	250	162	....	
9	95	73	93	130	458	880	2,635	430	70	70	232	162	....	
10	117	73	105	145	430	905	1,870	430	70	70	215	145	....	
11	57	93	105	162	430	1,125	1,920	458	70	70	180	102	....	
12	57	93	105	180	430	1,345	1,920	485	70	80	162	130	....	
13	57	93	105	198	430	1,565	1,870	380	70	80	145	145	....	
14	65	93	105	215	430	1,785	1,630	310	70	80	145	145	....	
15	65	93	105	232	430	2,020	1,582	290	70	70	145	162	....	
16	65	93	105	232	405	1,935	1,970	310	90	70	145	145	....	
17	65	93	105	232	405	1,835	1,772	250	102	90	145	130	....	
18	65	93	105	215	380	1,735	1,488	232	130	70	145	130	....	
19	65	93	105	215	380	1,635	1,488	250	115	70	115	145	....	
20	65	93	105	215	380	1,535	1,300	198	115	70	102	145	....	
21	73	93	105	215	430	1,300	1,392	232	120	70	80	145	....	
22	73	93	105	215	430	1,300	1,300	250	120	70	90	145	....	
23	73	93	105	215	485	1,440	1,255	198	120	102	145	145	....	
24	73	93	105	232	545	1,772	1,255	162	125	102	145	145	......	
25	73	93	105	250	610	1,870	990	145	125	90	145	145	....	
26	73	93	105	270	680	2,120	948	162	130	90	145	145	....	
27	73	93	105	290	680	1,920	545	145	130	115	145	145	....	
28	73	93	105	310	680	2,060	645	145	198	90	130	145	....	
29	73	105	....	330	680	2,200	430	145	162	102	130	145	....	
30	73	105	....	330	680	2,340	430	162	115	130	102	145	....	
31	73	105	....	355	....	2,480	....	130	80	....	90	....	....	
Total	2,440	2,812	2,832	6,293	14,474	44,942	50,986	9,229	3,282	2,663	5,895	4,159	....	Period 1911
Mean	79	91	101	203	482	1,450	1,700	298	106	89	190	139	....	442
Maximum	130	105	105	355	680	2,480	2,640	515	198	145	545	180	....	2,640
Minimum	57	73	93	105	380	680	430	130	70	70	80	102	....	70
Run-off per square mile	0.138	0.159	0.177	0.355	0.842	2.535	2.972	0.521	0.185	0.156	0.332	0.243	....	0.773
Run-off, depth, inches	0.159	0.183	0.184	0.409	0.939	2.923	3.315	0.601	0.213	0.174	0.383	0.271	....	9.595
Run-off, acre-feet	4,840	5,578	5,617	12,482	28,709	89,141	101,129	18,305	6,510	5,282	11,693	8,249	....	292,695
Acre-feet per square mile	8.46	9.75	9.82	21.82	50.20	155.83	176.81	32.00	11.38	9.23	20.44	14.42	....	511.70

DISCHARGE OF YAMPA RIVER AT STEAMBOAT SPRINGS FOR 1912

Drainage Area, 572 Square Miles. Altitude, 6,680 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	195	160	195	970	3,380	2,250	810	230	250	212	....	
2	....	130	130	195	1,240	3,560	1,930	740	212	230	160	....	
3	....	115	130	230	1,330	4,065	1,630	610	195	230	100	....	
4	....	195	130	270	1,060	4,390	1,480	500	178	230	250	....	
5	....	270	130	315	1,015	4,390	1,430	475	160	250	195	....	
6	....	315	130	360	970	4,130	1,480	405	160	270	160	....	
7	....	250	130	405	1,195	4,000	1,580	405	160	270	270	....	
8	....	212	130	450	1,430	3,935	1,480	382	145	270	250	....	
9	....	145	130	500	1,430	4,130	1,430	360	145	250	270	....	
10	....	130	130	550	1,380	3,870	1,285	338	195	270	230	....	
11	....	115	145	550	1,105	3,680	1,195	315	195	292	270	....	
12	....	130	145	580	1,150	3,320	1,240	292	195	270	270	....	
13	....	145	145	525	940	3,140	1,195	270	160	270	195	....	
14	....	160	145	405	1,015	2,910	1,330	250	195	250	195	....	
15	....	100	145	405	1,285	2,635	1,060	270	230	250	212	....	
16	....	115	130	475	1,630	2,140	970	405	230	250	230	....	
17	....	130	160	580	1,530	1,730	810	338	270	270	195	....	
18	....	115	130	640	1,630	1,480	740	292	270	230	178	....	
19	....	130	130	775	1,730	1,430	810	270	270	250	195	....	
20	....	160	160	740	1,830	1,680	740	270	250	270	195	....	
21	....	130	160	450	2,305	1,980	700	280	230	270	230	....	
22	....	195	195	450	2,690	2,195	700	212	212	230	160	....	
23	....	130	160	450	2,800	2,470	670	195	230	250	160	....	
24	....	130	160	580	2,855	2,800	670	195	270	270	160	....	
25	....	130	160	850	2,910	2,690	640	178	250	250	130	....	
26	....	130	160	940	2,910	2,580	640	160	270	250	178	....	
27	....	130	160	890	2,965	2,525	970	160	270	292	130	....	
28	....	130	195	970	2,470	2,415	890	230	270	315	130	....	
29	....	160	230	970	2,580	2,360	740	230	270	270	130	....	
30	....	....	230	1,060	3,060	2,415	775	338	270	270	130	....	
31	....	....	195	....	3,500	....	810	315	....	270	....	....	
Total	....	4,522	4,770	16,755	56,930	88,425	34,220	10,440	6,587	8,059	5,770	....	Period
Mean	....	156	154	558	1,836	2,948	1,104	337	220	260	192	....	778
Maximum	....	315	230	1,060	3,500	4,390	2,250	810	270	315	270	....	4,390
Minimum	....	100	130	195	940	1,430	640	160	145	230	100	....	100
Run-off per square mile	....	0.273	0.269	0.976	3.210	5.153	1.932	0.589	0.384	0.454	0.338	....	1.362
Run-off, depth, inches	....	0.294	0.310	1.089	3.701	5.749	2.227	0.679	0.428	0.523	0.377	....	15.377
Run-off, acre-feet	....	8,970	9,461	33,234	112,920	175,391	67,876	20,708	13,065	15,985	11,445	....	469,055
Acre-feet per square mile	....	15.68	17.41	58.10	197.41	306.62	118.66	36.20	22.84	27.95	20.01	....	820.88

YAMPA RIVER AT CRAIG

This station, established by the United States Geological Survey in 1901, is now maintained by the State. It is located on a road bridge one mile south of Craig.

The equipment consists of a standard chain gauge.

The channel is composed of rocks and gravel, and shifts slightly. Both banks overflow at high stages.

The observer is Fred A. Aiken, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF YAMPA RIVER AT CRAIG

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 11	C. L. Chatfield	110	2.49	3.60	263
	May 23	Chatfield & Kruger	1,136	3.10	5.10	3,455
	May 28	Chatfield & Turner	1,257	3.48	5.80	4,471
	June 6	Chatfield & Turner	1,411	4.15	6.35	5,851
	June 23	C. L. Chatfield	1,204	3.30	5.56	3,974
	June 28	Chatfield & Pughe	1,030	2.37	4.62	2,442
	July 11	C. L. Chatfield	835	1.16	3.40	973
	Aug. 8	Chatfield & Duer	70	2.94	2.45	206
	Sept. 23	C. L. Chatfield	55	2.38	2.20	131
	Oct. 26	C. L. Chatfield	89	3.71	2.60	330
1912	Feb. 15	C. L. Chatfield	111	1.80	....	200
	Apr. 15	Chatfield & Foote	745	1.75	3.38	1,300
	Apr. 23	C. L. Chatfield	758	1.81	3.45	1,369
	Apr. 28	Chatfield & Taylor	909	2.87	4.66	2,604
	May 1	C. L. Chatfield	1,118	3.62	5.45	4,041
	May 11	C. L. Chatfield	1,251	4.45	6.20	5,571
	May 28	C. L. Chatfield	1,584	5.57	7.60	8,830
	June 15	C. L. Chatfield	1,563	4.34	6.70	6,788
	Aug. 3	Chatfield & Ault	1,078	1.36	4.00	1,470

DISCHARGE OF YAMPA RIVER AT CRAIG FOR 1911

Drainage Area, 1,730 Square Miles. Altitude, 6,185 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	325	....	....	....	1,132	3,000	4,455	1,808	425	172	615	260	....	
2	260	....	....	....	1,455	2,490	5,025	1,935	390	172	790	260	....	
3	260	....	....	....	1,745	2,350	4,598	1,685	358	172	700	260	....	
4	260	....	....	....	2,280	2,775	4,740	1,745	292	230	658	260	....	
5	260	....	....	....	2,140	2,775	4,598	1,625	292	230	838	230	....	
6	260	....	....	....	1,935	3,955	5,025	1,808	230	230	1,808	325	....	
7	260	....	....	....	1,685	4,598	5,025	1,745	230	172	1,290	260	....	
8	260	....	....	....	1,400	4,740	4,882	1,578	230	172	932	230	....	
9	260	....	....	....	1,238	6,825	7,350	1,510	230	172	700	260	....	
10	260	....	....	....	1,510	8,315	4,740	1,132	230	120	658	260	....	
11	260	....	....	....	1,578	6,650	4,700	980	230	120	615	260	....	
12	260	....	....	....	1,290	4,585	4,585	885	230	120	535	260	....	
13	260	....	....	....	1,132	4,470	4,940	790	230	120	535	260	....	
14	260	....	....	....	980	4,940	4,940	745	230	120	390	260	....	
15	260	....	....	....	932	4,740	4,585	700	230	120	390	260	....	
16	260	....	....	....	885	4,882	4,820	658	230	120	390	260	....	
17	260	....	....	....	932	5,178	6,825	658	230	120	390	260	....	
18	260	....	....	....	885	5,025	4,455	745	230	120	390	260	....	
19	260	....	....	....	932	4,882	4,940	658	172	120	390	260	....	
20	260	....	....	....	980	4,585	4,190	658	172	120	390	260	....	
21	260	....	....	....	1,030	4,150	4,700	615	172	95	325	260	....	
22	260	....	....	....	1,185	3,160	4,700	575	390	95	325	292	....	
23	260	....	....	....	1,745	3,320	3,955	615	292	95	325	260	....	
24	260	....	....	....	2,420	4,050	3,490	700	292	145	390	260	....	
25	260	....	....	....	2,630	4,360	3,240	575	292	200	390	260	....	
26	260	....	....	....	2,775	4,585	2,700	575	292	172	358	260	....	
27	260	....	....	....	3,320	4,700	2,560	535	292	145	325	260	....	
28	260	....	....	....	3,860	4,940	2,210	496	230	200	325	260	....	
29	260	....	....	....	4,360	5,065	2,140	496	172	200	325	260	....	
30	260	....	....	....	3,670	4,222	1,935	496	172	230	325	260	....	
31	260	....	....	....	....	4,222	....	425	172	....	260	....	....	
Total	8,125	....	....	....	54,041	138,534	131,048	30,151	7,859	4,619	17,077	7,837	....	Period 1911
Mean	262	....	....	....	1,801	4,469	4,368	973	254	154	551	261	....	1,603
Maximum	325	....	....	....	4,360	8,315	7,350	1,935	425	230	1,808	325	....	8,315
Minimum	260	....	....	....	885	2,350	1,935	425	172	95	260	230	....	95
Run-off per square mile	0.152	....	....	....	1.041	2.583	2.525	0.562	0.147	0.089	0.318	0.151	....	0.927
Run-off, depth, inches	0.175	....	....	....	1.162	2.978	2.817	0.648	0.170	0.099	0.367	0.168	....	8.412
Run-off, acre-feet	16,110	....	....	....	107,190	274,782	259,934	59,804	15,588	9,162	33,872	15,544	....	775,876
Acre-feet per square mile	9.31	....	....	....	61.96	158.82	150.25	34.57	9.01	5.30	19.58	8.99	....	448.36

DISCHARGE OF YAMPA RIVER AT CRAIG FOR 1912

Drainage Area, 1,730 Square Miles. Altitude, 6,185 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				1,490	3,815	9,420	5,450	1,745	932	700	790		
2				1,490	4,360	8,720	4,700	1,875	790	615	700		
3				1,700	4,700	8,860	3,955	1,685	700	615	700		
4				2,430	3,650	9,420	3,490	1,455	700	700	700		
5				2,990	3,055	10,285	3,490	1,290	700	700	700		
6				2,670	2,670	9,995	3,320	1,238	615	700	700		
7				3,190	3,055	10,140	3,080	1,185	615	700	700		
8				2,730	3,985	10,285	3,320	1,185	615	790	700		
9				2,670	5,450	9,850	3,320	1,080	615	790	700		
10				2,925	5,710	9,560	3,320	1,080	615	790	700		
11				2,085	4,190	9,280	3,080	980	615	790	700		
12				2,430	5,065	8,720	3,160	932	700	790	790		
13				1,920	4,470	7,740	3,160	885	615	790	790		
14				1,345	3,410	7,600	3,320	790	615	790	790		
15				1,255	3,410	6,915	3,405	838	615	790	790		
16				1,645	3,650	5,710	2,775	980	700	700	790		
17				2,030	5,320	4,700	2,560	980	700	790	700		
18				2,195	7,050	3,860	2,420	932	700	700	700		
19				2,370	7,580	3,490	2,210	885	700	700	700		
20				2,195	9,000	3,580	2,560	790	700	700	700		
21				1,645	8,720	4,150	2,560	790	700	700	700		
22				1,540	9,000	4,700	2,000	745	700	700	700		
23				1,440	8,860	5,450	2,070	700	700	700	700		
24				1,645	8,860	5,970	2,000	700	700	700	615		
25				2,370	9,000	5,970	1,685	700	615	700	700		
26				2,670	9,705	5,580	1,625	700	615	790	700		
27				2,550	9,560	5,710	1,745	615	700	790	700		
28				2,730	8,860	5,840	2,000	615	700	790	700		
29				3,055	7,740	5,450	1,935	615	700	790	700		
30				3,335	7,880	5,580	1,808	980	700	790	700		
31					8,860		1,745	980		790			
Total				66,735	190,640	212,530	87,268	30,950	20,387	22,880	21,455		Period
Mean				2,224	6,150	7,084	2,815	998	680	738	715		2,632
Maximum				3,335	9,705	10,285	5,450	1,875	932	790	790		10,285
Minimum				1,255	2,670	3,490	1,625	615	615	615	615		615
Run-off per square mile				1.286	3.561	4.095	1.627	0.577	0.393	0.426	0.413		1.521
Run-off, depth, inches				1.435	4.106	4.569	1.876	0.665	0.438	0.491	0.461		14.041
Run-off, acre-feet				132,369	378,145	421,553	173,097	61,389	40,437	45,383	42,556		1,294,919
Acre-feet per square mile				76.51	218.58	243.67	100.06	35.48	23.37	26.23	24.60		748.50

YAMPA RIVER NEAR MAYBELL

This station, now maintained by the State, was first established by the United States Geological Survey in 1904, and is located at Thornburg bridge eight miles below Maybell.

The equipment consists of a cable with car, and a staff gauge bolted to the old bridge pier a short distance above cable.

The section is composed of cobblestones and sand, and is permanent.

The observer is Peter E. Farrell, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF YAMPA RIVER NEAR MAYBELL

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Aug. 14	C. L. Chatfield	482	0.41	0.72	196
	Oct. 8	Chatfield & Fincher	666	1.94	2.50	1,291
1912	Apr. 25	C. L. Chatfield	760	2.21	2.93	1,677
	Apr. 26	C. L. Chatfield	909	2.88	3.70	2,619
	June 13	C. L. Chatfield	1,816	4.95	7.00	8,986
	Aug. 12	C. L. Chatfield	666	1.20	1.83	798

DISCHARGE OF YAMPA RIVER NEAR MAYBELL FOR 1911
Drainage Area, 3,670 Square Miles. Altitude, 5,900 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1								2,935	345	255	278	395		
2								2,740	300	300	345	322		
3								2,675	300	345	530	255		
4								2,548	255	255	780	445		
5							4,960	2,422	215	235	1,120	445		
6							5,480	2,340	165	255	1,680	530		
7							5,032	2,282	165	235	1,955	560		
8							5,105	1,845	138	198	2,282	395		
9							5,180	1,790	138	215	2,168	370		
10							5,555	1,735	125	235	1,955	322		
11							5,330	1,680	125	165	2,340	300		
12							5,105	1,628	165	150	1,955	255		
13							4,525	1,575	150	235	1,845	322		
14							4,452	1,575	180	215	1,628	370		
15							5,105	1,575	198	165	2,340	395		
16							5,855	1,525	198	180	2,360	345		
17							4,380	1,475	180	198	1,955	345		
18							4,235	1,380	215	215	1,735	395		
19							4,162	1,290	300	235	1,575	395		
20							4,090	1,080	322	255	1,475	395		
21							3,805	965	255	370	1,248	395		
22							3,875	745	235	420	1,120	395		
23							3,738	680	255	590	1,080	395		
24							4,162	650	198	500	965	395		
25							4,162	650	198	370	815	395		
26							4,018	560	255	255	712	395		
27							3,945	590	278	235	650	395		
28							3,535	500	235	235	472	395		
29							2,400	472	215	215	420	395		
30							2,935	395	180	235	395	395		
31								345	198		370			
Total							115,126	44,647	6,681	7,966	40,548	11,506		Period 1911
Mean							4,428	1,440	216	266	1,308	384		1,265
Maximum							5,855	2,935	345	590	2,360	560		5,855
Minimum							2,400	345	125	150	278	255		125
Run-off per square mile							1.207	0.392	0.059	0.072	0.356	0.105		0.345
Run-off, depth, inches							1.167	0.452	0.068	0.080	0.410	0.117		2.294
Run-off, acre-feet							228,353	88,556	13,252	15,800	80,426	22,822		449,209
Acre-feet per square mile							62.22	24.13	3.61	4.30	21.91	6.22		122.39

DISCHARGE OF YAMPA RIVER NEAR MAYBELL FOR 1912

Drainage Area 3,670 Square Miles. Altitude 5,900 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				2,375	8,130	13,640	5,825	1,088	670	740	890		
2				2,682	9,375	12,815	5,720	1,310	1,175	815	1,045		
3				3,345	7,530	13,220	5,510	1,088	1,265	1,045	1,405		
4				3,720	5,370	8,130	4,200	705	1,045	670	1,500		
5				3,000	5,825	9,000	3,960	670	605	518	1,595		
6				2,375	4,910	11,330	3,960	890	465	368	1,045		
7				3,000	5,100	11,600	3,880	1,088	670	345	1,405		
8				2,682	5,825	11,735	3,645	1,548	852	390	1,045		
9				2,375	6,945	12,140	3,570	890	778	575	852		
10				1,800	7,530	11,195	3,345	545	638	670	1,045		
11				2,082	8,130	10,270	3,270	740	415	740	670		
12				2,375	5,370	9,880	3,000	705	465	928	605		
13				3,345	5,825	9,125	2,495	638	670	1,045	465		
14				2,375	5,300	9,375	2,870	670	705	1,220	390		
15				2,375	4,720	9,000	3,000	440	815	1,500	490		
16				3,000	5,370	8,500	2,495	575	928	1,405	605		
17				2,682	7,530	8,625	2,375	670	928	1,310	670		
18				2,375	8,130	8,250	1,910	928	1,045	1,405	740		
19				2,082	9,375	7,650	1,910	1,265	1,500	1,500	605		
20				1,800	8,750	7,650	1,645	1,595	1,405	1,548	815		
21				2,082	9,375	7,290	1,310	1,748	965	1,500	778		
22				1,968	10,400	6,945	1,405	1,500	815	1,310	852		
23				1,968	11,060	7,530	1,088	1,695	670	1,175	1,130		
24				1,855	12,005	7,530	1,175	2,315	605	1,045	1,265		
25				1,748	12,005	6,830	1,045	670	465	670	1,500		
26				2,682	8,750	5,370	1,130	928	670	605	1,175		
27				2,435	8,010	5,825	890	1,265	740	440	740		
28				2,140	9,375	5,825	1,088	1,265	740	465	740		
29				5,825	10,790	5,615	1,045	852	605	670	518		
30				6,945	12,950	5,825	545	740	390	740	605		
31					12,950		890	740		852			
Total				81,493	252,710	267,715	80,196	31,766	23,704	28,209	26,825		Period
Mean				2,716	8,152	8,924	2,587	1,024	790	910	894		3,248
Maximum				6,945	12,950	13,640	5,825	2,315	1,500	1,548	1,595		13,640
Minimum				1,748	4,720	5,370	545	440	390	345	390		345
Run-off per square mile				0.740	2.221	2.432	0.705	0.279	0.215	0.248	0.243		0.885
Run-off, depth, inches				0.826	2.561	2.713	0.813	0.322	0.240	0.286	0.271		8.032
Run-off, acre-feet				161,642	501,250	531,013	159,065	63,008	47,017	55,943	53,207		1,572,145
Acre-feet per square mile				44.05	136.58	144.69	43.34	17.17	12.81	15.24	14.49		428.37

SODA CREEK AT STEAMBOAT SPRINGS

This station was located at road bridge on Main street. Steamboat Springs, and was maintained during 1911 in co-operation with the town of Steamboat Springs. It was discontinued September, 1911.

The equipment consisted of a chain gauge located on the bridge.

The bed of the stream is composed of cobbles and is permanent.

The observer at this station was paid by the town of Steamboat Springs.

DISCHARGE MEASUREMENTS OF SODA CREEK AT STEAMBOAT SPRINGS.

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 21	C. L. Chatfield				2
May 16	C. L. Chatfield	56	5.30	2.80	297
May 20	C. L. Chatfield	43	3.56	2.35	153
May 22	C. L. Chatfield	37	3.35	2.22	124
June 17	C. L. Chatfield	66	3.41	2.52	225
July 24	C. L. Chatfield	24	0.71	1.30	17
Aug. 29	Chatfield & Ault	2	0.42	0.80	1
Sept. 13	C. L. Chatfield	2	0.56	0.85	1
Oct. 31	C. L. Chatfield	4	2.11	1.20	8

DISCHARGE OF SODA CREEK AT STEAMBOAT SPRINGS FOR 1911

Drainage Area, 47 Square Miles. Altitude, 6,680 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1							270	100	8					
2							185	69	6.5					
3							290	69	5					
4							350	63	5					
5							350	69	2.5					
6							310	69	2.5					
7							410	57	1.8					
8							370	57	1					
9							330	47	1					
10							270	47	1					
11							290	47	1					
12							290	47	1					
13							270	47	1					
14							350	38	1					
15						350	430	30	1					
16						310	560	30	1					
17						310	390	30	1					
18						200	390	26	1					
19						180	450	23	1					
20						158	410	23	1					
21						120	350	23	1					
22						120	430	23	2.5					
23						218	310	17	3.8					
24						218	185	17	2.5					
25						252	132	12	2.5					
26						252	185	12	2.5					
27						270	158	12	2.5					
28						252	145	8	2.5					
29						235	100	8	2.5					
30						290	92	8	2.5					
31						290		8	2.5					
Total						4,025	9,052	1,136	71.6					Period
Mean						237	302	37	2.3					131
Maximum						350	560	100	8					560
Minimum						120	92	8	1					1
Run-off per square mile						5.042	6.426	0.787	0.049					2.787
Run-off, depth, inches						3.188	7.169	0.907	0.056					12.292
Run-off, acre-feet						7,984	17,954	2,253	142					28,333
Acre-feet per square mile						169.87	382.00	47.97	3.02					602.83

ELK RIVER AT HINMAN PARK

This station is located just above the mouth of the South Fork of Elk river, and eight miles above Clark post office. It was established May 25, 1912, and is maintained in co-operation with The Elk River Irrigation & Construction Company.

The equipment consists of a Bristol automatic gauge, staff gauge and cable with car, owned by The Elk River Irrigation & Construction Company.

The bed of the stream is rough but permanent.

The observer, Milbank G. Franz, is paid $5.00 per month by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF ELK RIVER AT HINMAN PARK

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 May 14	C. L. Chatfield	56	2.89	0.50	162
May 25	C. L. Chatfield	149	5.44	2.20	811
July 2	C. L. Chatfield	138	5.00	2.00	690
July 18	C. L. Chatfield	118	3.91	1.60	461
Sept. 10	C. L. Chatfield	48	1.81	0.31	87
Nov. 10	W. P. Finley	39	1.72	0.22	68

DISCHARGE OF ELK RIVER AT HINMAN PARK FOR 1912

Drainage Area, 61 Square Miles. Altitude, 7,800 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						955	755	260	105	82			
2						1,025	658	260	90	75			
3						1,100	565	230	90	75			
4						1,175	510	205	90	90			
5						1,255	460	192	82	98			
6						1,335	438	180	90	90			
7						1,255	565	170	82	82			
8						1,215	658	170	75	75			
9						1,295	658	160	82	75			
10						1,100	658	160	90	75			
11						990	625	160	90	75			
12						955	658	150	90	75			
13						955	690	130	90	75			
14						755	820	130	82	90			
15						595	658	130	75	75			
16						415	722	140	75	75			
17						350	485	130	90	75			
18						330	510	112	90	75			
19						330	625	105	82	75			
20						438	565	98	75	70			
21						625	415	98	82	70			
22						690	392	98	82	75			
23						920	370	98	82	75			
24						920	330	90	75	75			
25					885	990	312	98	75	75			
26					722	990	278	98	90	75			
27					510	920	330	105	82	75			
28					485	920	312	120	82	75			
29					658	955	228	170	82	75			
30					852	885	205	140	75	75			
31					885		295	112		75			
Total					4,997	26,638	15,750	4,499	2,522	2,397			Period
Mean					714	888	508	145	84	77			355
Maximum					885	1,335	820	260	105	98			1,335
Minimum					485	330	205	.90	75	70			70
Run-off per square mile					11.708	14.564	8.328	2.377	1.377	1.262			4 820
Run-off, depth, inches					3.048	16.249	9.601	2.741	1.537	1.455			34 631
Run-off, acre-feet					9,912	52,836	31,241	8,924	5,002	4,754			112,668
Acre-feet per square mile					162.59	866.16	512.15	146.30	82.00	77.93			1,847.13

ELK RIVER AT KINNEY'S RANCH NEAR CLARK

This station, established in 1910, is located one mile above Clark post office on road to Hahn's Peak. It is maintained in co-operation with The Elk River Irrigation & Construction Company.

The equipment consists of a standard chain gauge owned by the State.

The bed of the stream is composed of boulders and is rough, but permanent.

The observer is Milbank G. Franz, whose salary, $5.00 per month, is paid by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF ELK RIVER AT KINNEY'S RANCH NEAR CLARK

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 20	C. L. Chatfield	56	1.11	....	62
	June 11	C. L. Chatfield	245	5.86	5.05	1,437
	June 19	Chatfield & Bowers	245	5.90	5.05	1,446
	July 22	Chatfield & Bowers	134	2.98	3.50	399
	July 23	Chatfield & Bowers	122	2.82	3.30	345
	Sept. 18	C. L. Chatfield	59	0.98	2.15	58
1912	Feb. 22	C. L. Chatfield	37	1.29	....	48
	May 13	C. L. Chatfield	198	3.66	3.92	725
	July 2	C. L. Chatfield	211	5.28	4.75	1,114
	July 19	C. L. Chatfield	165	5.20	4.10	857
	July 25	C. L. Chatfield	135	3.46	3.40	467
	July 30	C. L. Chatfield	129	3.46	3.30	447
	Aug. 20	C. L. Chatfield	78	2.09	2.50	163
	Sept. 10	C. L. Chatfield	77	1.81	2.52	139

DISCHARGE OF ELK RIVER AT KINNEY'S RANCH NEAR CLARK FOR 1911

Drainage Area, 213 Square Miles. Altitude, 7,300 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	55						1,780	640	250	122				
2	55						1,580	700	238	122				
3	55						1,780	670	225	122				
4	55						1,830	640	205	122				
5	55						1,780	640	205	122				
6	55						1,680	585	185	122				
7	55						1,580	535	185	115				
8	55						2,335	490	185	115				
9	55						1,780	405	185	115				
10	55						1,680	405	175	115				
11	55						1,730	405	175	115				
12	55						1,780	388	175	115				
13	55						1,780	370	165	115				
14	55						1,780	370	165	130				
15	55						1,880	370	165	138				
16	55						2,460	370	165	130				
17	55						1,680	335	165	115				
18	55						1,580	335	155	108				
19	55						1,480	335	155	108				
20	55						1,480	335	155	100				
21	55						1,480	305	165	108				
22	55						1,480	388	185	100				
23	55						1,380	370	185	100				
24	55						1,380	335	145	100				
25	55						1,245	305	130	100				
26	55						1,000	305	130	92				
27	55						700	305	130	92				
28	55						700	290	130	92				
29	55						670	290	122	92				
30	55						640	275	122	165				
31	55							262	122					
Total	1,705						46,060	2,753	5,244	3,407				Period 1911
Mean	55						1,535	411	169	114				553
Maximum	55						2,460	700	250	165				2,460
Minimum	56						640	262	122	92				92
Run-off per square mile	0.258						7.207	1.930	0.793	0.535				2.596
Run-off, depth, inches	0.298						8.041	2.225	0.914	0.597				11.777
Run-off, acre-feet	3,382						91,359	25,296	10,401	6,758				133,814
Acre-feet per square mile	15.88						428.92	118.75	48.83	31.72				628.22

DISCHARGE OF ELK RIVER AT KINNEY'S RANCH NEAR CLARK FOR 1912

Drainage Area, 213 Square Miles. Altitude, 7,300 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				65	470	3,835	1,080	390	205	105	125		
2				65	555	2,920	1,180	390	175	150	105		
3				85	632	3,750	1,180	390	175	175	105		
4				85	580	3,280	1,080	310	175	150	105		
5				95	450	3,430	1,180	390	175	175	105		
6				95	532	4,470	1,050	390	175	105	105		
7				105	660	3,670	990	350	150	125	105		
8				125	1,320	3,835	1,145	350	205	125	105		
9				190	2,040	4,470	930	310	175	125	125		
10				190	2,395	4,375	1,020	350	150	105	125		
11				175	1,552	2,990	1,020	310	150	85	125		
12				175	870	1,430	1,020	390	150	125	85		
13				162	1,285	1,355	960	350	150	105	105		
14				175	1,985	1,552	990	350	175	85	105		
15				175	750	1,355	930	350	150	65	85		
16				190	1,020	1,355	840	310	175	65	85		
17				205	840	1,595	605	310	150	85	85		
18				235	750	1,780	580	350	175	85	85		
19				235	2,850	1,932	660	310	125	85	85		
20				205	2,850	1,780	780	310	150	85	85		
21				205	3,350	1,932	720	310	125	85	85		
22				205	3,750	1,355	632	310	150	105	105		
23				270	4,010	1,510	632	270	125	125	85		
24				270	3,280	1,510	605	270	105	85	85		
25				270	3,590	1,595	555	270	125	85	105		
26				270	3,920	1,595	532	235	105	65	85		
27				290	3,510	1,430	450	270	105	85	85		
28				350	2,525	1,510	490	235	85	65	85		
29				390	2,785	1,250	450	205	65	85	85		
30				555	3,835	1,320	410	235	85	65	85		
31					3,430		430	175		105			
Total				6,107	62,376	70,166	25,126	9,745	4,385	3,165	2,930		Period
Mean				204	2,012	2,339	812	314	146	102	98		754
Maximum				555	4,010	4,470	1,180	390	205	175	125		4,470
Minimum				65	450	1,250	410	175	65	65	85		65
Run-off per square mile				0.958	9.446	10.981	3.812	1.474	0.685	0.479	0.460		3.540
Run-off, depth, inches				1.069	10.890	12.252	4.395	1.699	0.764	0.552	0.513		32.134
Run-off, acre-feet				12,113	123,722	139,175	49,837	19,329	8,698	6,278	5,811		364,964
Acre-feet per square mile				56.87	580.85	653.40	233.98	90.75	40.84	29.47	27.28		1,713.44

ELK RIVER AT TRULL

This station, maintained by the State and established by the United States Geological Survey in 1904, is located six miles below Steamboat Springs on the road to Craig.

The equipment consists of a standard chain gauge.

The bed of the stream is composed of boulders and conditions are excellent for a mountain stream.

Both banks overflow at high water.

The observer is Fred O. Smith, who is paid $5.00 per month.

DISCHARGE MEASUREMENTS OF ELK RIVER AT TRULL

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 7*	C. L. Chatfield	137	0.68	....	93
	May 16	C. L. Chatfield	519	5.23	8.98	2,716
	June 7	Chatfield & Turner	531	5.41	9.10	2,875
	July 24	Chatfield & Maxwell	144	2.60	6.00	375
	Aug. 31	Chatfield & Finley	69	1.32	5.07	91
	Sept. 15	Chatfield & Maxwell	74	1.38	5.12	102
1912	Feb. 24*	C. L. Chatfield	80	0.88	....	70
	Apr. 12	C. L. Chatfield	148	2.53	6.05	374
	May 12	C. L. Chatfield	384	4.98	8.25	1,912
	May 23	C. L. Chatfield	562	6.40	9.75	3,594
	June 23	C. L. Chatfield	452	5.91	8.75	2,672
	July 23	C. L. Chatfield	272	4.42	7.17	1,205
	Aug. 30	C. L. Chatfield	132	2.51	5.94	331

*Ice conditions.

DISCHARGE OF ELK RIVER AT TRULL FOR 1911

Drainage Area, 415 Square Miles. Altitude, 6,650 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	73	....	....	....	388	1,220	2,670	1,258	251	80	700	148	....	
2	61	....	....	....	458	1,145	2,670	1,258	251	80	642	122	....	
3	75	....	....	....	559	1,145	2,511	1,145	219	80	507	100	....	
4	75	....	....	....	671	1,540	2,564	1,182	204	111	304	122	....	
5	75	....	....	....	586	2,199	2,834	1,108	204	100	762	100	....	
6	75	....	....	....	532	2,670	2,947	1,145	174	100	1,258	100	....	
7	75	....	....	....	458	2,458	2,834	1,000	161	100	1,036	100	....	
8	75	....	....	....	532	3,004	3,526	929	161	100	894	100	....	
9	75	....	....	....	482	3,352	3,120	795	174	100	507	100	....	
10	75	....	....	....	507	3,120	2,199	642	174	80	366	122	....	
11	75	....	....	....	507	2,148	2,148	614	174	80	304	122	....	
12	75	....	....	....	434	1,902	2,511	532	174	80	304	122	....	
13	75	....	....	....	344	2,250	2,564	532	148	90	268	122	....	
14	75	....	....	....	304	2,199	2,511	532	148	100	204	122	....	
15	75	....	....	....	268	2,834	2,511	482	148	100	204	161	....	
16	75	....	....	....	268	2,724	2,670	458	148	90	204	161	....	
17	75	....	....	....	344	2,617	3,062	482	148	80	174	148	....	
18	75	....	....	....	411	2,724	2,511	482	135	80	174	148	....	
19	75	....	....	....	458	2,199	2,890	458	148	80	174	148	....	
20	75	....	....	204	586	1,760	2,724	411	148	71	161	148	....	
21	75	....	....	204	700	1,457	2,458	388	148	80	148	148	....	
22	75	....	....	204	828	1,416	2,564	411	148	122	174	148	....	
23	75	....	....	189	964	1,540	2,098	411	148	148	174	148	....	
24	75	....	....	234	1,072	1,999	1,950	388	148	148	148	148	....	
25	75	....	....	204	1,220	2,048	1,626	344	148	148	148	148	....	
26	75	....	....	174	1,416	2,148	1,582	304	148	161	148	148	....	
27	75	....	....	148	1,715	1,854	1,416	344	148	148	148	148	....	
28	75	....	....	148	1,950	1,760	1,457	304	122	135	135	148	....	
29	75	....	....	161	1,902	2,098	1,457	304	100	135	122	148	....	
30	75	....	....	189	1,715	2,048	1,220	268	100	148	122	148	....	
31	75	....	....	268	....	2,406	....	268	80	....	122	....	....	
Total	2,309	....	....	2,327	22,579	65,984	71,805	19,179	4,930	3,155	10,736	3,996	....	Period 1911
Mean	74	....	....	194	753	2,128	2,394	619	159	105	347	133	....	800
Maximum	75	....	....	268	1,950	3,352	3,526	1,258	251	161	1,258	161	....	3,526
Minimum	61	....	....	148	268	1,145	1,220	268	80	71	122	100	....	71
Run-off per square mile	0.179	....	....	0.467	1.814	5.128	5.769	1.491	0.383	0.253	0.836	0.320	....	1.928
Run-off, depth, inches	0.207	....	....	0.208	2.024	5.912	6.436	1.719	0.442	0.282	0.969	0.357	....	18,356
Run-off, acre-feet	4,580	....	....	4,616	44,785	130,877	142,423	38,041	9,779	6,258	21,295	7,926	....	406,000
Acre-feet per square mile	11.04	....	....	11.12	107.97	315.60	343.28	91.67	23.56	15.08	51.31	19.10	....	978.40

DISCHARGE OF ELK RIVER AT TRULL FOR 1912

Drainage Area, 415 Square Miles. Altitude, 6,650 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	1,530	3,300	1,980	595	370	155	180	....	
2	....	....	....	....	1,745	3,410	1,980	520	300	155	180	....	
3	....	....	....	....	1,655	3,760	1,980	445	210	155	180	....	
4	....	....	....	....	1,610	3,880	1,930	370	155	155	180	....	
5	....	....	....	....	1,610	3,880	1,930	370	155	155	180	....	
6	....	....	....	....	1,610	3,820	1,980	370	155	155	180	....	
7	....	....	....	370	1,610	3,760	1,700	370	155	168	180	....	
8	....	....	....	370	1,880	3,640	1,700	350	130	180	180	....	
9	....	....	....	370	2,380	3,700	1,790	370	130	155	180	....	
10	....	....	....	390	2,630	3,700	1,790	370	130	155	180	....	
11	....	....	....	430	2,330	3,460	1,790	370	130	155	180	....	
12	....	....	....	300	1,880	1,650	1,450	370	155	155	180	....	
13	....	....	....	300	1,700	1,560	1,370	370	155	155	180	....	
14	....	....	....	300	1,490	1,800	1,370	450	155	155	180	....	
15	....	....	....	300	1,410	1,560	1,210	500	155	155	180	....	
16	....	....	....	330	1,745	1,560	1,210	500	155	155	180	....	
17	....	....	....	330	2,780	1,090	1,130	450	130	155	180	....	
18	....	....	....	475	2,780	1,250	1,130	450	130	155	180	....	
19	....	....	....	550	3,700	1,290	1,130	450	130	155	180	....	
20	....	....	....	500	3,640	1,790	1,050	450	155	155	180	....	
21	....	....	....	370	3 520	2,130	970	450	155	155	180	....	
22	....	....	....	350	3,580	2,480	970	450	155	155	180	....	
23	....	....	....	350	3,640	2,600	970	500	155	155	180	....	
24	....	....	....	640	3,520	2,780	970	500	155	155	180	....	
25	....	....	....	740	3,640	2,780	970	500	155	155	180	....	
26	....	....	....	705	3,580	2,780	970	500	155	155	180	....	
27	....	....	....	810	3,580	2,880	970	500	155	155	180	....	
28	....	....	....	930	2,930	2,980	895	500	155	168	180	....	
29	....	....	....	970	3,520	2,980	820	500	155	180	180	....	
30	....	....	....	1,090	3,880	2,680	745	500	155	180	180	....	
31	....	....	....	....	3,880	....	670	410	....	180	....	....	
Total	....	....	....	12,270	80,985	80,930	41,520	13,800	4,890	4,931	5,400	....	Period
Mean	....	....	....	511	2,612	2,698	1,339	445	163	159	180	....	1,028
Maximum	....	....	....	1,090	3,880	3,880	1,980	595	370	180	180	....	3,880
Minimum	....	....	....	300	1,410	1,090	670	350	130	155	180	....	130
Run-off per square mile	....	....	....	1.231	6.294	6.502	3.227	1.072	0.393	0.383	0.434	....	2.477
Run-off, depth, inches	....	....	....	1.104	7.256	7.254	3.721	1.236	0.438	0.442	0.484	....	21.935
Run-off, acre-feet	....	....	....	24,338	160,634	160,524	82,355	27,372	9,699	9,781	10,711	....	485,414
Acre-feet per square mile	....	....	....	58.65	387.07	386.80	198.45	65.96	23.37	23.57	25.81	....	1,169.68

MAD CREEK NEAR STEAMBOAT SPRINGS

This station was established July 1, 1912, on the highway bridge six miles from Steamboat Springs on the road to Hahn's Peak. It is maintained in co-operation with F. A. Metcalf of Steamboat Springs.

The equipment is a staff gauge bolted to left abutment of bridge from which measurements are made. The channel is composed of boulders and is rough but permanent. The current is swift at high stages. The observer E. H. O'Neal, is paid $5.00 per month by F. A. Metcalf.

DISCHARGE MEASUREMENTS OF MAD CREEK NEAR STEAMBOAT SPRINGS

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 July 1	C. L. Chatfield	100	5.42	2.50	542
July 3	C. L. Chatfield	92	4.53	2.35	417
July 20	C. L. Chatfield	78	4.22	2.20	329
July 26	C. L. Chatfield	49	2.84	1.85	139
Aug. 29	C. L. Chatfield	16	1.38	1.08	22

DISCHARGE OF MAD CREEK NEAR STEAMBOAT SPRINGS FOR 1912

Drainage Area, 40 Square Miles. Altitude, 6,740 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1							630	172	34	17	48		
2							450	172	34	17	48		
3							412	140	24	24	48		
4							375	140	17	24	48		
5							310	140	13	24	34		
6							282	88	13	34	34		
7							255	88	13	34	34		
8							375	66	12	34	24		
9							375	48	13	34	24		
10							495	48	17	34	24		
11							540	34	17	24	24		
12							540	34	17	24	24		
13							450	24	17	17	24		
14							450	24	24	17	24		
15							450	24	24	17	24		
16							375	24	24	17	24		
17							412	24	24	17	24		
18							412	24	24	17	24		
19							412	17	24	17	24		
20							310	17	24	17	34		
21							255	17	17	17	34		
22							255	17	13	17	34		
23							255	17	13	17	34		
24							232	13	17	17	34		
25							210	13	17	24	34		
26							210	13	17	24	34		
27							210	13	17	34	34		
28							210	17	17	34	34		
29							172	17	17	34	34		
30							172	24	17	34	34		
31							172	34		48			
Total							10,663	1,543	571	760	956		Period
Mean							344	50	19	25	32		95
Maximum							630	172	34	48	48		630
Minimum							172	13	12	17	24		12
Run-off per square mile							8.600	1.250	0.475	0.625	0.800		2.375
Run-off, depth, inches							9 915	1.441	0.548	0.721	0.893		13.518
Run-off, acre-feet							21,150	3,060	1,132	1,507	1,896		28,745
Acre-feet per square mile							528.75	76.50	28.30	37.68	47.40		718.63

ELK HEAD CREEK NEAR CRAIG

This station, now maintained by the State, was first established by the United States Geological Survey in 1906, and is located six miles above Craig, on the road to Steamboat Springs.

The equipment consists of a standard chain gauge.

The section is composed of rocks and sand and is permanent.

Both banks overflow at high water.

The observer is U. F. Harrison, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF ELK HEAD CREEK NEAR CRAIG

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 11*	C. L. Chatfield	7.5	1.87		14
	May 23	C. L. Chatfield	137	3.38	7.14	464
	June 6	Chatfield & Turner	87	2.01	5.73	175
	June 22	C. L. Chatfield	64	1.78	5.20	114
	July 13	C. L. Chatfield	9	1.39	4.23	12.5
	Sept. 22	C. L. Chatfield			3.50	0
1912	Feb. 15*	C. L. Chatfield	6	1.66		10
	Apr. 28	C. L. Chatfield	125	2.83	6.76	354
	May 11	C. L. Chatfield	206	3.72	8.71	767
	May 27	C. L. Chatfield	396	3.70	10.85	1,459
	June 16	C. L. Chatfield	107	2.80	5.92	300
	Aug. 15	C. L. Chatfield	4.8	1.00	3.77	4.8

*Ice conditions.

DISCHARGE OF ELK HEAD CREEK NEAR CRAIG FOR 1911

Drainage Area, 249 Square Miles. Altitude, 6,200 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	6	....	....	....	462	578	284	18	6	0	18	6	....	
2	6	....	....	....	312	525	256	24	4.5	0	18	6	....	
3	6	....	....	....	422	536	238	24	3	0	34	6	....	
4	6	....	....	....	392	621	220	24	2	0	38	6	....	
5	6	....	....	....	312	942	195	21	1	0	50	6	....	
6	6	....	....	....	247	1,045	179	27	1	0	94	6	....	
7	6	....	....	....	294	1,110	179	27	1	0	50	6	....	
8	6	....	....	....	322	1,178	163	24	0.5	0	24	6	....	
9	6	....	....	....	342	1,218	148	24	0.5	0	15	6	....	
10	6	....	....	....	238	892	148	21	0.5	0	6	6	....	
11	6	....	....	....	187	621	127	21	0.5	0	6	10	....	
12	6	....	....	....	148	643	107	15	0.5	0	6	10	....	
13	6	....	....	....	141	666	107	15	0.5	0	6	10	....	
14	6	....	....	....	100	770	94	18	0.5	0	6	15	....	
15	6	....	....	....	100	758	75	6	0.5	0	6	15	....	
16	6	....	....	....	107	867	144	6	0.5	0	6	15	....	
17	6	....	....	....	107	818	212	8	0.5	0	4	6	....	
18	6	....	....	....	148	794	141	15	0.5	0	2	10	....	
19	6	....	....	....	163	700	163	12	0.5	0	6	6	....	
20	6	....	....	....	312	462	141	12	0.5	0	6	10	....	
21	6	....	....	....	342	392	107	27	0.5	0	6	6	....	
22	6	....	....	....	402	382	141	21	0.5	0	10	6	....	
23	6	....	....	....	472	442	81	15	0.5	0	12	6	....	
24	6	....	....	....	483	472	69	15	0.5	0	6	6	....	
25	6	....	....	....	610	494	54	15	0.2	0	6	6	....	
26	6	....	....	....	734	483	41	15	0	0	10	6	....	
27	6	....	....	....	867	392	30	10	0	0	10	6	....	
28	6	....	....	....	806	352	24	10	0	0	10	6	....	
29	6	....	....	....	610	332	21	8	0	0.5	6	6	....	
30	6	....	....	....	723	303	15	6	0	0.5	6	6	....	
31	6	....	....	....	....	294	....	6	0	....	6	....	....	
Total	186	....	....	....	10,905	20,082	3,904	510	27.2	1.0	489	227	....	Period 1911
Mean	6	....	....	....	364	648	130	16	0.9	0.03	16	7.6	....	148
Maximum	6	....	....	....	867	1,218	284	27	6	0.5	94	15	....	1,218
Minimum	6	....	....	....	100	294	15	6	0	0	2	6	....	0
Run-off per square mile	0.024	....	....	....	1.462	2.602	0.522	0.064	0.004	0.000	0.064	0.030	....	0.594
Run-off, depth, inches	0.028	....	....	....	1.632	3.000	0.582	0.074	0.005	0.000	0.074	0.033	....	5.400
Run-off, acre-feet	369	....	....	....	21,626	39,826	7,742	1,011	54	2	970	450	....	71,680
Acre-feet per square mile	1.68	....	....	....	86.83	159.94	31.10	4.06	0.22	0.01	3.90	1.81	....	287.86

DISCHARGE OF ELK HEAD CREEK NEAR CRAIG FOR 1912

Drainage Area, 249 Square Miles. Altitude, 6,200 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				76	570	840	41	6	4	3	6		
2				128	708	852	41	6	4	3	6		
3				150	842	930	41	6	3	3	6		
4				258	590	904	34	6	2	2	4		
5				303	294	865	34	6	2	2	4		
6				294	294	642	27	6	2	2	4		
7				195	560	520	27	4	2	2	4		
8				241	819	480	20	4	2	2	4		
9				322	928	550	18	4	2	2	4		
10				510	1,097	420	15	4	3	2	4		
11				312	1,080	294	15	4	3	2	4		
12				460	928	285	10	3	3	2	4		
13				218	1,002	250	10	3	3	2	15		
14				88	510	210	18	3	2	2	15		
15				114	370	188	24	3	2	3	10		
16				142	854	225	18	3	2	3	6		
17				135	988	218	10	3	3	3	4		
18			12	150	1,520	210	8	3	3	3	3		
19			15	165	1,755	165	6	2	2	3	3		
20			10	107	1,520	150	20	2	2	4	3		
21			15	142	1,565	100	20	2	2	4	3		
22			6	142	1,452	100	15	2	2	4	3		
23			6	114	1,388	94	10	3	2	4	3		
24			10	107	1,367	82	6	3	2	4	3		
25			18	642	1,409	76	6	3	3	4	3		
26			18	500	1,452	76	6	2	3	4	2		
27			30	312	1,346	65	6	2	3	15	2		
28			50	294	1,180	55	10	2	2	20	1		
29			82	510	1,064	41	10	2	2	18	1		
30			76	400	1,033	41	10	2	2	15	1		
31			100		1,130		8	3		10			
Total			448	7,531	31,615	9,928	544	107	74	148	135		Period
Mean			32	251	1,020	331	18	3	2	5	4		196
Maximum			100	642	1,755	930	41	6	4	20	15		1,755
Minimum			6	76	294	41	6	2	2	2	1		1
Run-off per square mile			0.128	1.008	4.097	1.329	0.072	0.012	0.008	0.021	0.016		0.787
Run-off, depth, inches			0.066	1.125	4.724	1.483	0.083	0.014	0.009	0.024	0.018		7.546
Run-off, acre-feet			889	14,937	62,708	19,693	1,079	212	147	294	268		100,227
Acre-feet per square mile			3.57	59.99	251.84	79.09	4.33	0.85	0.59	1.18	1.08		402.52

FORTIFICATION CREEK AT CRAIG

This station, now maintained by the State, was first established by the United States Geological Survey in 1904, and is located one-eighth mile east of main street of Craig on road to Hayden.

The equipment consists of a standard chain gauge.

The section is composed of sand and is very shifting. Both banks overflow at high water.

The observer is Mrs. E. L. Jameson, whose salary is $4.00 per month.

DISCHARGE MEASUREMENTS OF FORTIFICATION CREEK AT CRAIG

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 12*	C. L. Chatfield	6	1.42	....	8
	Mar. 10	E. S. Foote	317	1.18	9.90	375
	May 24	C. L. Chatfield	53	1.88	4.47	100
	June 6	Chatfield & Turner	25	1.48	3.70	37
	June 23	C. L. Chatfield	26	1.62	3.75	42
	July 13	C. L. Chatfield		....	....	0.5
	Aug. 8	C. L. Chatfield		....	....	0
	Sept. 22	C. L. Chatfield		....	....	0
1912	Apr. 14	C. L. Chatfield	44	1.91	4.10	84
	Apr. 28	C. L. Chatfield	86	2.34	5.46	201
	May 11	C. L. Chatfield	65	3.52	6.46	229
	June 16	C. L. Chatfield	47	2.32	4.75	109

*Ice conditions.

DISCHARGE OF FORTIFICATION CREEK AT CRAIG FOR 1911

Drainage Area, 256 Square Miles. Altitude, 6,185 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					95	125	55	10	0	0	82	12		
2					115	105	60	5	0	0	30	12		
3					115	100	50	5	0	0	70	12		
4					120	110	35	5	0	0	27	12		
5					105	165	40	5	0	0	152	12		
6					75	250	40	5	0	0	128	12		
7					70	250	30	3	0	0	44	12		
8				500	60	270	40	2	0	0	20	12		
9				410	65	320	40	0.5	0	0	13	12		
10				450	75	310	35	0.5	0	0	11	12		
11				220	85	195	30	0.5	0	0	11	15		
12				170	65	150	25	0.5	0	0	9	15		
13				135	55	135	25	0.5	0	0	8	15		
14				135	50	140	80	0.5	0	0	6	15		
15				135	45	150	40	0.5	0	0	6	15		
16				195	45	150	35	0.5	0	0	6	15		
17				210	50	140	55	13	0	0	6	15		
18				125	60	140	50	1	0	0	6	15		
19				165	75	120	60	1	0	0	6	15		
20				165	85	90	50	1	0	0	6	15		
21				235	100	80	50	0.5	75	0	6	18		
22				190	115	85	50	0.5	60	0	6	16		
23				165	125	85	45	0.5	10	0	6	16		
24				125	135	95	35	0.5	0	0	6	16		
25				95	135	95	30	0.5	0	0	6	16		
26				60	130	80	25	0	0	0	6	15		
27				50	160	80	25	0	0	0	6	15		
28				60	185	65	20	0	0	0	6	15		
29				65	210	60	20	0	0	0	6	15		
30				95	125	50	10	0	0	0	6	15		
31				115		50		0	0		6			
Total				4,270	2,930	4,235	1,185	51.5	145	0	717	427		Period
Mean				178	98	137	39.5	1.7	4.7	0	23	14		52
Maximum				500	210	320	80	13	75	0	152	18		500
Minimum				50	45	50	10	0	0	0	6	12		0
Run-off per square mile				0.695	0.383	0.535	0.154	0.007	0.008	0	0.090	0.055		0.203
Run-off, depth, inches				0.619	0.427	0.617	0.172	0.008	0.009	0	0.104	0.061		2.017
Run-off, acre-feet				8,468	5,812	8,400	2,350	102	288	0	1,422	847		27,689
Acre-feet per square mile				33.05	22.70	32.81	9.18	0.40	1.12	0	5.56	3.31		108.16

DISCHARGE OF FORTIFICATION CREEK AT CRAIG FOR 1912

Drainage Area, 256 Square Miles. Altitude, 6,185 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				230	270	320	20	1	15				
2				230	350	345	22	1	5				
3				230	385	385	17	1	2				
4				230	190	410	15	1	2				
5				183	130	380	15	1	2				
6				230	105	315	15	0	2				
7					135	265	10	0	2				
8					300	480	8	0	2				
9					465	345	7	0	2				
10					400	245	5	0	2				
11					290	195	5	0	2				
12					280	175	2	0	2				
13					190	155	2	0	2				
14				75	140	140	2	0	2				
15				70	160	120	18	0	5				
16				115	270	105	8	0	5				
17				115	490	85	7	13	4				
18				115	535	75	3	8	3				
19				155	565	70	3	5	2				
20				115	520	65	3	5	2				
21				95	550	65	4	4	3				
22				100	510	50	4	2	2				
23				85	490	50	4	1	2				
24				95	520	50	4	1	2				
25				200	510	50	4	0	2				
26				245	530	45	4	0	2				
27				180	480	35	4	0	2				
28				185	275	35	4	0	2				
29				260	335	25	4	0	2				
30				245	470	22	4	15	2				
31					480		3	15					
Total				3,783	11,320	5,102	230	74	83				Period
Mean				164	365	170	7	2	3				117
Maximum				260	565	480	22	15	12				565
Minimum				70	105	22	2	0	2				0
Run-off per square mile				0.641	1.426	0.664	0.027	0.008	0.012				0.457
Run-off, depth, inches				0.450	1.644	0.741	0.031	0.009	0.013				2.888
Run-off, acre-feet				7,504	22,453	10,120	456	147	165				40,845
Acre-feet per square mile				29.31	87.71	39.53	1.78	0.57	0.64				159.54

TROUT CREEK AT PINNACLE

This station, maintained in co-operation with the Williams River Highline Irrigation Company, was located one-fourth mile above Pinnacle post office. It was discontinued December 31, 1911.

The equipment consisted of a staff gauge driven into the bed of the creek and braced to tree.

The bed of the stream is composed of gravel and boulders and is permanent.

The observer, Mrs. D. M. Chapman, was paid $4.00 per month by the Williams River Highline Irrigation Company.

DISCHARGE MEASUREMENTS OF TROUT CREEK AT PINNACLE

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 23	C. L. Chatfield	12	0.96	1.80	11
May 26	C. E. Turner	20	3.36	2.50	66
July 15	C. L. Chatfield	14	1.38	1.95	20
Aug. 26	C. L. Chatfield	12	1.08	1.87	13
Oct. 28	C. L. Chatfield	10	0.92	1.78	10

DISCHARGE OF TROUT CREEK AT PINNACLE FOR 1911

Drainage Area, 27 Square Miles.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	12	....	....	9	9	17	159	49	17	11	17	11	11	
2	12	....	....	9	9	17	202	36	17	11	14	11	11	
3	12	....	....	9	11	21	145	36	17	11	17	11	11	
4	12	....	....	9	11	25	145	36	17	14	21	11	11	
5	12	....	....	7	11	36	173	36	14	14	30	7	11	
6	12	....	....	7	11	49	173	36	11	11	21	7	11	
7	12	....	....	9	11	56	202	36	11	11	21	7	11	
8	12	....	....	9	9	64	232	36	11	11	21	7	7	
9	12	....	....	9	11	80	188	30	11	11	17	21	11	
10	12	....	....	9	11	36	132	25	11	11	17	21	11	
11	12	....	....	11	11	36	132	25	17	11	17	21	11	
12	12	....	....	7	11	42	145	25	14	11	14	11	11	
13	12	....	....	9	7	56	132	21	14	11	14	11	11	
14	12	....	....	7	7	80	120	17	14	11	11	11	11	
15	12	....	....	9	11	80	80	21	14	11	11	11	11	
16	12	....	....	9	11	80	80	21	11	11	11	21	11	
17	12	....	....	9	11	80	72	21	11	11	9	17	11	
18	12	....	....	9	11	89	80	21	11	11	7	11	11	
19	12	....	....	9	14	56	80	17	11	11	7	11	11	
20	12	....	....	9	17	49	80	17	11	11	7	11	11	
21	12	....	....	7	17	49	72	17	11	11	17	11	11	
22	12	....	....	7	17	49	80	17	14	9	80	11	11	
23	12	....	....	7	17	64	64	17	17	11	42	11	11	
24	12	....	....	11	17	72	64	17	17	11	11	11	11	
25	12	....	....	7	17	98	56	17	17	11	11	11	11	
26	12	....	....	7	17	98	56	17	14	11	14	11	11	
27	12	....	....	11	25	80	56	17	14	11	11	11	11	
28	12	....	....	7	25	80	56	17	14	11	11	11	11	
29	12	....	....	9	25	98	49	17	14	11	11	11	11	
30	12	....	....	9	25	120	49	17	11	11	11	11	11	
31	12	....	....	9	....	145	....	17	11	....	11	....	11	
Total	372	....	....	265	417	2,002	3,354	749	419	334	534	360	337	Period 1911
Mean	12	....	....	8.5	14	65	112	24	14	11	17	12	11	29
Maximum	12	....	....	11	25	145	232	49	17	14	80	21	11	232
Minimum	12	....	....	7	7	17	49	17	11	9	7	7	7	7
Run-off per square mile	0.444	....	....	0.317	0.515	2.392	4.141	0.895	0.501	0.412	0.638	0.444	0.403	1.074
Run-off, depth, inches	0.512	....	....	0.365	0.575	2.757	4.620	1.032	0.577	0.459	0.736	0.495	0.465	12.209
Run-off, acre-feet	738	....	....	526	827	3,971	6,653	1,486	831	662	1,059	714	668	17,397
Acre-feet per square mile	27.33	....	....	19.48	30.63	147.07	246.41	55.04	30.78	24.52	39.22	26.44	24.74	644.33

WILLIAMS RIVER NEAR PYRAMID

This station was located at Dunstan's ranch three miles below Pyramid post office and was maintained in co-operation with the Williams River Highline Irrigation Company. It was discontinued November 11, 1911.

The equipment consisted of a staff gauge bolted to crib pier of foot bridge from which measurements were made.

The bed of the stream is composed of gravel and boulders and is permanent.

The observer, Edna B. Evans, was paid $5.00 per month by the Williams River Highline Irrigation Company.

DISCHARGE MEASUREMENTS OF WILLIAMS RIVER NEAR PYRAMID

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 10*	C. L. Chatfield	34	0.85	1.60	29
May 26	C. E. Turner	84	3.77	2.45	318
July 14	C. L. Chatfield	48	1.75	1.80	84
Aug. 24	Ault & Chatfield	42	1.12	1.50	47
Oct. 27	C. L. Chatfield	37	0.92	1.35	34

*Ice conditions.

DISCHARGE OF WILLIAMS RIVER NEAR PYRAMID FOR 1911

Drainage Area, 98 Square Miles. Altitude, 7,500 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	35	....	....	23	51	128	462	214	51	36	44	31	....	
2	43	....	....	23	62	114	436	195	51	36	51	31	....	
3	23	....	....	23	62	128	410	178	51	36	62	31	....	
4	29	....	....	23	62	195	436	178	51	36	62	31	....	
5	43	....	....	23	62	315	462	160	51	36	214	31	....	
6	29	....	....	23	44	315	436	160	51	36	86	31	....	
7	51	....	....	26	31	315	436	160	51	36	62	36	....	
8	43	....	....	31	31	518	790	160	51	36	51	36	....	
9	29	....	....	31	44	678	518	160	51	36	51	36	....	
10	29	....	....	31	51	386	436	160	51	36	36	36	....	
11	23	....	....	31	62	272	436	144	51	36	36	36	....	
12	23	....	....	31	51	315	462	144	51	36	36	....	....	
13	23	....	....	36	44	338	436	128	51	36	36	....	....	
14	19	....	....	36	44	518	436	128	36	31	31	....	....	
15	19	....	....	31	36	462	410	128	36	31	36	....	....	
16	23	....	....	31	44	410	361	128	36	36	31	....	....	
17	13	....	....	31	44	462	361	128	36	36	26	....	....	
18	19	....	....	31	44	436	436	128	36	36	26	....	....	
19	23	....	....	26	44	386	361	114	36	36	31	....	....	
20	19	....	....	31	44	315	338	114	44	36	31	....	....	
21	19	....	....	31	51	252	386	99	73	36	31	....	....	
22	29	....	....	31	86	252	361	128	73	36	36	....	....	
23	23	....	....	31	114	361	361	99	51	36	36	....	....	
24	19	....	....	26	99	361	338	99	51	36	36	....	....	
25	21	....	....	26	99	361	294	86	44	36	36	....	....	
26	21	....	....	36	144	361	272	99	36	26	36	....	....	
27	21	....	....	31	195	338	195	99	36	26	31	....	....	
28	21	....	....	36	214	338	160	99	36	31	31	....	....	
29	21	....	....	31	214	361	195	99	36	44	31	....	....	
30	21	....	....	31	160	386	178	86	36	44	36	....	....	
31	21	....	....	36	....	436	....	62	36	....	31	....	....	
Total	795	....	....	918	2,333	10,813	11,599	4,064	1,431	1,061	1,410	366	....	Period 1911
Mean	26	....	....	30	78	349	387	130	46	35	45	33	....	133
Maximum	51	....	....	36	214	678	790	214	73	44	214	36	....	790
Minimum	13	....	....	23	36	114	160	62	36	26	26	31	....	23
Run-off per square mile	0.265	....	....	0.306	0.795	3.561	3.953	1.327	0.470	0.357	0.459	0.337	....	1.357
Run-off, depth, inches	0.306	....	....	0.353	0.887	4.106	4.410	1.530	0.542	0.398	0.529	0.139	....	12.920
Run-off, acre-feet	1,577	....	....	1,821	4,627	21,439	23,007	8,061	2,838	2,105	2,797	720	....	67,409
Acre-feet per square mile	16.09	....	....	18.58	47.22	218.77	234.71	82.26	28.96	21.48	28.44	7.34	....	687.85

WILLIAMS RIVER AT HAMILTON

This station, located on highway bridge fourteen miles from Craig on the road to Meeker, was established in 1904 by the United States Geological Survey and is now maintained by the State.

The equipment consists of a standard chain gauge located on the bridge.

The bed of the stream is composed of rocks and gravel and is shifting in character.

The observer is Carrie A. Hamilton, whose salary is $4.00 per month.

DISCHARGE MEASUREMENTS OF WILLIAMS RIVER AT HAMILTON

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 8	C. L. Chatfield	42	1.45	3.00	61
	May 25	C. E. Turner	225	3.75	5.37	844
	June 30	C. L. Chatfield	110	2.00	3.53	220
	July 10	C. L. Chatfield	85	1.62	3.15	138
	Aug. 23	Chatfield & Ault	28	1.64	2.62	46
	Oct. 10	C. L. Chatfield	64	1.22	2.80	78
	Oct. 25	C. L. Chatfield	60	1.05	2.70	63
1912	Feb. 10	C. L. Chatfield	32	1.41	....	45
	Apr. 15	C. L. Chatfield	75	1.57	3.00	110
	Apr. 23	C. L. Chatfield	81	1.54	3.10	125
	June 3	C. L. Chatfield	355	4.42	7.67	1,572
	Aug. 5	C. L. Chatfield	92	1.90	3.35	175

DISCHARGE OF WILLIAMS RIVER AT HAMILTON FOR 1911

Drainage Area, 341 Square Miles. Altitude, 6,400 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	....	108	125	804	204	58	36	143	43	....	
2	....	....	....	....	108	295	730	238	58	36	125	43	....	
3	....	....	....	....	125	320	678	215	58	43	125	43	....	
4	....	....	....	....	183	386	678	204	58	43	108	43	....	
5	....	....	....	....	162	626	713	194	58	58	260	43	....	
6	....	....	....	....	134	840	696	194	50	58	272	43	....	
7	....	....	....	....	134	859	713	183	50	58	152	43	....	
8	....	....	....	....	125	1,118	1,052	172	43	50	91	43	....	
9	....	....	....	....	116	1,234	992	152	43	43	91	43	....	
10	....	....	....	....	125	1,164	878	134	43	43	82	43	....	
11	....	....	....	....	116	914	748	125	43	43	66	43	....	
12	....	....	....	143	108	610	562	108	43	43	58	....	....	
13	....	....	....	143	108	804	577	108	43	43	58	....	....	
14	....	....	....	116	116	933	577	100	43	58	58	....	....	
15	....	....	....	125	82	896	643	108	36	58	58	....	....	
16	....	....	....	91	108	992	562	108	36	43	50	....	....	
17	....	....	....	108	116	1,052	562	100	36	43	43	....	....	
18	....	....	....	82	100	914	546	91	36	43	43	....	....	
19	....	....	....	82	125	840	577	91	36	43	43	....	....	
20	....	....	....	91	125	610	577	82	30	43	24	....	....	
21	....	....	....	100	162	515	785	74	43	43	19	....	....	
22	....	....	....	91	204	500	626	82	58	43	30	....	....	
23	....	....	....	100	249	626	440	108	50	43	66	....	....	
24	....	....	....	100	272	859	386	91	43	43	58	....	....	
25	....	....	....	91	215	696	358	82	43	43	58	....	....	
26	....	....	....	74	320	840	332	74	36	43	58	....	....	
27	....	....	....	108	332	626	284	58	36	58	58	....	....	
28	....	....	....	100	470	594	272	91	36	58	58	....	....	
29	....	....	....	100	238	626	238	66	36	58	43	....	....	
30	....	....	....	100	260	696	215	58	36	58	43	....	....	
31	....	....	....	108	....	730	....	58	36	....	43	....	....	
Total	....	....	....	2,053	5,146	22,840	17,801	3,753	1,354	1,418	2,476	473	....	Period
Mean	....	....	....	103	172	737	593	121	44	47	80	43	....	234
Maximum	....	....	....	143	470	1,234	1,052	238	58	58	272	43	....	1,234
Minimum	....	....	....	74	82	125	215	58	30	36	19	43	....	19
Run-off per square mile	....	....	....	0.302	0.504	2.161	1.739	0.354	0.129	0.138	0.235	0.126	....	0.686
Run-off, depth, inches	....	....	....	0.225	0.562	2.492	1.940	0.408	0.149	0.158	0.271	0.052	....	6.248
Run-off, acre-feet	....	....	....	4,072	10,207	45,302	35,308	7,444	2,686	2,813	4,911	938	....	113,681
Acre-feet per square mile	....	....	....	11.94	29.93	132.84	103.55	21.83	7.88	8.25	14.40	2.75	....	333.37

DISCHARGE OF WILLIAMS RIVER AT HAMILTON FOR 1912

Drainage Area, 341 Square Miles. Altitude, 6,400 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				152	272	1,436	745	272	100	91	74		
2				172	295	1,510	676	260	91	91	74		
3				183	295	1,676	643	249	74	91	74		
4				194	295	1,752	577	215	74	91	91		
5				172	249	1,658	546	183	74	91	91		
6				143	226	1,602	484	162	66	91	91		
7				152	295	1,621	470	162	58	91	91		
8				152	426	1,771	484	152	58	91	108		
9				183	470	1,714	426	143	66	91	108		
10				152	426	1,454	399	143	74	91	100		
11				152	412	1,306	358	125	74	74	91		
12				172	372	1,086	372	125	74	74	82		
13				152	345	1,177	372	116	74	74	74		
14				134	295	1,068	372	108	74	74	74		
15				134	332	996	345	108	74	74	74		
16				116	426	816	320	125	74	74	74		
17				125	626	676	295	125	74	74	74		
18				143	960	594	272	116	74	74	74		
19				152	1,232	562	272	108	74	74	74		
20				134	1,362	594	308	108	74	74	74		
21				116	1,658	676	284	108	74	74	74		
22				125	1,602	693	249	100	74	74	74		
23				143	1,640	780	249	91	74	74	74		
24				143	1,454	762	238	82	91	74	74		
25				134	1,752	780	215	74	91	74	74		
26				134	1,828	834	215	74	91	74	74		
27				116	1,771	852	295	74	91	74	74		
28				152	1,288	834	372	143	91	74	74		
29				183	1,510	762	295	134	91	74	74		
30				249	1,752	745	284	162	91	74	74		
31					2,056		260	143		74			
Total				4,564	27,922	32,787	11,692	4,290	2,339	2,464	2,407		Period
Mean				152	901	1,093	377	138	78	79	80		363
Maximum				249	2,056	1,771	745	272	100	91	108		2,056
Minimum				116	226	562	215	74	58	74	74		58
Run-off per square mile				0.446	2.642	3.205	1.106	0.405	0.229	0.232	0.234		1.064
Run-off, depth, inches				0.498	3.046	3.576	1.275	0.467	0.256	0.268	0.261		9.647
Run-off, acre-feet				9,053	55,384	65,034	23,191	8,509	4,629	4,887	4,774		175,461
Acre-feet per square mile				26.55	162.56	190.71	68.02	24.95	13.58	14.33	13.71		514.41

FISH CREEK AT DUNKLEY

This station was located at wagon bridge one-fourth mile below Dunkley's ranch and was maintained in co-operation with the Williams River Highline Irrigation Company. It was discontinued November 30. 1911.

The equipment consisted of a staff gauge driven into the bed of the stream and braced to bank.

The bed of the stream is composed of sand, gravel and mud and is permanent.

The observer was R. S. Bird, who was paid $4.00 per month by the Williams River Highline Irrigation Company.

DISCHARGE MEASUREMENTS OF FISH CREEK AT DUNKLEY

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 10........	C. L. Chatfield............................	4	1.99	....	8.1
May 27........	C. E. Turner..............................	12	1.60	2.70	20
July 13........	C. L. Chatfield......................	0.9	1.64	2.00	1.5
Aug. 26........	C. L. Chatfield............................	2.5	0.55	1.95	1.4

DISCHARGE OF FISH CREEK AT DUNKLEY FOR 1911

Drainage Area, 29 Square Miles. Altitude, 7,200 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1......................	6.7	....	....	15	25	26	17	7	3	1	11	2	....	
2......................	6.7	....	....	15	24	26	18	9	2	1	10	3	....	
3......................	6.7	....	....	15	24	30	17	8	2	1	7	2	....	
4......................	6.7	....	....	20	24	35	16	10	3	1	4	2	....	
5......................	6.7	....	....	20	26	35	16	7	2	1	15	2	....	
6......................	5.5	....	....	30	22	60	15	5	3	1	13	2	....	
7......................	6.1	....	....	32	24	74	16	6	2	1	11	3	....	
8......................	6.7	....	....	32	23	98	16	4	2	1	8	2	....	
9......................	6.1	....	....	60	20	124	16	2	2	1	5	2	....	
10......................	5.5	....	....	92	20	134	16	1	1	1	5	2	....	
11......................	5.5	....	....	78	17	131	13	2	1	1	4	2	....	
12......................	5.5	....	....	26	17	104	14	2	1	1	4	1	....	
13......................	5.5	....	....	26	14	76	13	3	1	1	3	1	....	
14......................	5.5	....	....	17	14	53	14	4	1	1	3	1	....	
15......................	5.5	....	....	16	11	58	15	6	1	1	3	2	....	
16......................	5.5	....	....	18	11	56	22	8	1	1	3	1	....	
17......................	5.5	....	....	20	11	56	22	7	1	1	2	1	....	
18......................	5.5	....	....	27	10	52	22	4	1	1	2	1	....	
19......................	5.5	....	....	20	8	48	22	3	1	1	1	1	....	
20......................	5.5	....	....	22	10	46	23	3	1	1	1	0.5	....	
21......................	5.0	....	....	23	11	47	19	2	1	1	1	1	....	
22......................	5.0	....	....	22	12	42	18	2	1	1	3	1	....	
23......................	5.0	....	....	21	11	38	18	1	1	3	2	0.5	....	
24......................	5.0	....	....	20	12	32	14	2	1	2	2	1	....	
25......................	5.0	....	....	17	20	27	11	1	1	1	3	0.5	....	
26......................	5.0	....	....	20	23	22	9	2	1	1	2	0.5	....	
27......................	5.0	....	....	20	42	21	8	2	1	1	2	0.5	....	
28......................	5.0	....	....	22	53	20	6	2	1	2	2	0.5	....	
29......................	5.0	....	....	22	50	19	7	2	1	2	2	1	....	
30......................	5.0	....	....	25	26	17	7	2	1	2	2	0.5	....	
31......................	5.0	....	....	25	....	18	....	2	1	....	2	....	....	
Total...............	173	....	....	838	615	1,625	460	121	43	36	138	40.5	....	Period 1911
Mean......................	5.6	....	....	27	20	52	15	3.9	1.4	1.2	4.5	1.4	....	14.4
Maximum..................	6.7	....	....	92	53	134	23	10	3	3	15	3	....	134
Minimum..................	5.0	....	....	15	8	17	6	1	1	1	1	0.5	....	0.5
Run-off per square mile	0.193	....	....	0.932	0.707	1.808	0.529	0.135	0.048	0.041	0.154	0.047	....	0.497
Run-off, depth, inches......	0.223	....	....	1.074	0.789	2.085	0.590	0.156	0.056	0.046	0.177	0.053	....	5.087
Run-off, acre-feet..........	343	....	....	1,662	1,220	3,223	912	240	85	71	274	80	....	7,767
Acre-feet per square mile...	11.83	....	....	57.31	42.07	111.14	31.45	8.28	2.93	2.45	9.45	2.76	....	267.54

FOUR MILE CREEK AT RANGER'S STATION

This station, established May 3, 1912, is located twenty miles from Baggs, Wyoming, and one-half mile northeast of Ryan's ranch. It is maintained in co-operation with The Elk River Irrigation & Construction Company.

The equipment consists of a Bristol automatic gauge, staff gauge and foot bridge from which measurements are made.

The channel is constructed of cobblestones and will be permanent when settled.

The observer is C. C. Ryan, who is paid $5.00 per month by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF FOUR MILE CREEK AT RANGER'S STATION

DATE	HYDROGRAPHER	Area of Section Sq. Ft	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 May 3	C. L. Chatfield	5.3	1.40	0.63	7.4
May 10	C. L. Chatfield	6.5	2.20	0.83	14.3
May 29	C. L. Chatfield	16	4.81	1.42	77
June 21	W. P. Finley	9	1.56	0.80	14
Aug. 2	Ault & Chatfield	4.2	0.64	0.55	2.7
Aug. 23	W. P. Finley	4.5	0.56	0.48	2.5

DISCHARGE OF FOUR MILE CREEK AT RANGER'S STATION FOR 1912

Drainage Area, 4 (approx.) Square Miles. Altitude, 7,800 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1					5	50	8	5	2	2			
2					5	50	8	4	2	2			
3					8	56	8	2	2	2			
4					4	44	8	4	2	2			
5					2	38	8	2	2	2			
6					2	38	8	2	2	2			
7					5	50	7	2	2	2			
8					13	56	5	2	2	2			
9					20	38	5	2	2	2			
10					20	28	7	2	2	2			
11					20	24	7	2	2	2			
12					13	28	8	2	2	2			
13					8	28	7	2	2	2			
14					13	24	8	2	2	2			
15					28	20	8	2	2	2			
16					63	11	8	5	2	2			
17					84	8	8	4	2	2			
18					99	8	8	2	2	2			
19					84	8	8	2	2	2			
20					84	11	8	2	2	2			
21					91	13	7	2	2	2			
22					70	13	5	2	2	2			
23					70	16	5	2	1	2			
24					84	13	4	2	2	2			
25					91	11	4	2	2	2			
26					84	11	5	2	2	2			
27					63	13	5	2	2	2			
28					50	11	5	2	2	2			
29					70	8	4	2	2	2			
30					70	8	4	5	2	2			
31					63	....	5	2	....	2			
Total					1,386	735	203	77	59	62			Period
Mean					48	24	7	2	2	2			14
Maximum					99	56	8	5	2	2			99
Minimum					2	8	4	2	1	2			1
Run-off per square mile					12.000	6.000	1.750	0.500	0.500	0.500			3.425
Run-off, depth, inches					13.830	6.694	2.018	0.576	0.558	0.576			24.252
Run-off, acre-feet					2,749	1,458	403	153	117	123			5,002
Acre-feet per square mile					687.25	344.50	100.75	38.25	29.25	30.75			1,230.75

WILLOW CREEK AT RYAN'S RANCH

This station was established May 4, 1912, in co-operation with The Elk River Irrigation & Construction Company, and is located twenty-two miles from Baggs, Wyoming, and two miles northeast of Ryan's ranch.

The equipment consists of a Bristol automatic gauge and staff gauge.

The section is composed of small cobblestones, and was constructed for the station. Both banks are low but do not overflow.

The observer is C. C. Ryan, whose salary is $5.00 per month, paid by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF WILLOW CREEK AT RYAN'S RANCH

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 May 4	C. L. Chatfield	2.8	1.43	0.52	4.0
May 10	C. L. Chatfield	4.9	2.20	0.75	10.8
May 29	C. L. Chatfield	16	4.81	1.40	77
June 21	W. P. Finley	9	2.67	0.21	24
Aug. 2	C. L. Chatfield	4.6	1.35	—0.10	6.2
Aug. 23	W. P. Finley	4	1.14	—0.10	4.6

DISCHARGE OF WILLOW CREEK AT RYAN'S RANCH FOR 1912

Drainage Area, 5 (approx.) Square Miles. Altitude, 8,000 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						24	28	6	6	3			
2						33	28	6	6	3			
3						50	24	4	6	3			
4					4	80	20	4	4	3			
5					3	71	24	6	6	4			
6					3	79	20	6	6	3			
7					4	114	17	6	6	3			
8					8	128	17	6	6	3			
9					9	102	17	6	4	3			
10					11	87	14	6	6	3			
11						86	11	6	6	3			
12						84	14	6	4	3			
13						98	14	6	6	3			
14						74	24	6	8	3			
15						60	8	14	6	3			
16						42	6	11	6	3			
17					48	32	8	8	6	3			
18					55	28	11	8	8	3			
19					48	20	20	6	8	3			
20					48	24	17	6	8	3			
21					55	32	8	6	6	3			
22					42	42	6	6	6	3			
23					42	37	6	6	4	3			
24					48	37	6	6	6	3			
25					62	37	6	6	6	3			
26					55	37	6	4	6	3			
27					36	37	6	6	4	3			
28					32	37	6	6	4	3			
29					48	32	4	11	3	3			
30					55	28	4	24	3	3			
31					23		6	11		3			
Total					739	1,672	406	225	170	94			Period
Mean					34	56	13	7	6	3			19
Maximum					62	128	28	24	8	4			128
Minimum					3	20	4	4	3	3			3
Run-off per square mile					6.800	11.200	2.600	1.400	1.200	0.600			3.800
Run-off, depth, inches					5.566	12.493	2.998	1.614	1.339	0.692			24.702
Run-off, acre-feet					1,466	3,316	805	446	337	186			6,558
Acre-feet per square mile					293.20	663.20	161.00	89.20	67.40	37.20			1,311.20

LITTLE SNAKE RIVER AT DIXON, WYOMING

This station was established in 1910 by the State, and is located at steel wagon bridge one mile below Dixon, Wyoming.

The equipment consists of a standard chain gauge.

The channel is composed of boulders and gravel and shifts slightly during high stages. Both banks overflow during extreme stages.

The observer is Edith Madsen, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF LITTLE SNAKE RIVER AT DIXON, WYO.

DATE		HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911	Feb. 13*	C. L. Chatfield	56	2.52	....	141
	May 25	C. L. Chatfield	633	3.26	4.68	2,064
	June 25	Callon, Chatfield & Terrill	421	2.10	2.75	785
	June 27	C. L. Chatfield	389	1.65	2.40	643
	June 29	W. H. Terrill	268	1.75	2.20	471
	Sept. 25	C. L. Chatfield	18	1.88	0.62	34
1912	Feb. 13*	C. L. Chatfield	36	3.92	....	105
	May 5	C. L. Chatfield	397	2.40	2.95	951
	May 9	C. L. Chatfield	672	3.73	4.95	2,486
	May 31	C. L. Chatfield	868	7.52	7.18	6,535

*Ice conditions.

DISCHARGE OF LITTLE SNAKE RIVER AT DIXON, WYOMING, FOR 1911

Drainage Area, 1,294 Square Miles. Altitude, 6,300 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	140	585	1,425	2,688	360	22	12	610	85	....	
2	....	....	....	140	660	1,295	22,30	320	20	18	280	75	....	
3	....	....	....	140	760	1,230	2,070	320	18	15	360	85	....	
4	....	....	....	140	735	1,360	2,070	280	15	15	260	85	....	
5	....	....	....	140	685	1,805	2,110	280	12	10	380	160	....	
6	....	....	....	145	510	2,475	2,070	260	5	12	760	118	....	
7	....	....	....	145	465	2,432	1,990	225	12	12	465	95	....	
8	....	....	....	145	380	2,645	2,070	175	20	18	280	95	....	
9	....	....	....	145	442	3,000	2,150	190	15	18	208	105	....	
10	....	....	....	145	560	2,955	1,770	190	8	18	190	105	....	
11	....	....	....	145	535	2,475	1,595	105	10	18	190	95	....	
12	....	....	....	145	510	1,990	1,630	75	10	15	160	95	....	
13	....	....	....	145	360	2,150	1,630	75	12	12	160	95	....	
14	....	....	....	145	360	2,350	1,560	130	18	15	118	105	....	
15	....	....	....	145	320	2,645	1,560	42	15	15	105	85	....	
16	....	....	....	160	360	2,560	1,630	35	12	20	130	105	....	
17	....	....	....	190	380	2,475	1,700	42	12	22	118	130	....	
18	....	....	....	160	360	2,688	1,630	58	10	20	130	160	....	
19	....	....	....	160	488	2,350	1,560	65	10	22	130	160	....	
20	....	....	....	225	710	1,990	1,490	42	10	22	105	130	....	
21	....	....	....	340	810	1,840	1,425	50	12	25	65	118	....	
22	....	....	....	360	1,045	1,735	1,295	42	8	25	65	160	....	
23	....	....	....	420	1,165	2,030	1,105	35	8	30	105	105	....	
24	....	....	....	488	1,295	2,150	985	35	10	30	105	160	....	
25	....	....	....	400	1,360	2,070	810	42	10	25	118	160	....	
26	....	....	....	260	1,425	2,310	710	30	12	22	118	130	....	
27	....	....	....	242	1,770	2,150	610	22	12	25	105	130	....	
28	....	....	....	320	2,030	1,915	560	15	12	42	85	130	....	
29	....	....	....	242	2,110	1,990	465	30	8	50	85	130	....	
30	....	....	....	260	1,735	1,952	400	42	12	75	75	130	....	
31	....	....	....	400	....	2,110	....	20	12	....	85	....	....	
Total	....	....	....	6,777	24,910	66,547	45,568	3,632	382	678	6,150	3,521	....	Period 1911
Mean	....	....	....	219	830	2,147	1,519	117	12	23	198	117	....	575
Maximum	....	....	....	488	2,110	3,000	2,688	360	22	75	760	160	....	3,000
Minimum	....	....	....	140	320	1,230	400	15	5	10	65	75	....	5
Run-off per square mile	....	....	....	0.169	0.641	1.659	1.174	0.090	0.009	0.018	0.153	0.090	....	0.444
Run-off, depth, inches	....	....	....	0.195	0.715	1.913	1.310	0.104	0.010	0.020	0.176	0.100	....	4.543
Run-off, acre-feet	....	....	....	13,442	49,408	131,994	90,383	7,204	758	1,346	12,198	6,984	....	313,717
Acre-feet per square mile	....	....	....	10.39	38.18	102.00	69.85	5.57	0.59	1.04	9.43	5.40	....	242.44

DISCHARGE OF LITTLE SNAKE RIVER AT DIXON, WYOMING, FOR 1912

Drainage Area, 1,294 Square Miles. Altitude, 6,300 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	....	193	960	4,695	1,115	272	111	122	163	....	
2	....	....	....	255	1,241	4,695	960	238	49	100	122	....	
3	....	....	....	363	1,546	4,915	898	148	49	82	178	....	
4	....	....	....	462	1,177	5,480	720	122	49	82	208	....	
5	....	....	....	612	1,022	5,362	749	100	49	82	208	....	
6	....	....	....	485	778	5,025	639	91	34	100	208	....	
7	....	....	....	382	960	4,805	612	82	34	111	208	....	
8	....	....	....	441	1,694	4,695	558	57	34	148	193	....	
9	....	....	....	639	2,270	4,915	485	65	20	148	193	....	
10	....	....	....	720	2,500	4,915	382	74	34	148	193	....	
11	....	....	....	558	2,270	3,722	344	49	57	163	178	....	
12	....	....	....	639	2,315	3,098	325	42	65	148	223	....	
13	....	....	....	533	2,182	3,170	306	27	49	148	148	....	
14	....	....	....	420	1,850	2,895	558	20	65	148	148	....	
15	....	....	....	401	2,270	2,500	462	49	82	122	148	....	
16	....	....	....	420	2,650	2,450	344	65	100	122	111	....	
17	....	....	....	420	3,555	1,694	306	65	100	122	100	....	
18	....	....	....	420	4,695	1,476	238	57	100	122	111	....	
19	....	....	....	666	6,000	1,307	208	65	100	111	111	....	
20	....	....	....	558	5,480	1,307	306	42	100	135	135	....	
21	....	....	....	462	6,135	1,241	272	42	100	148	135	....	
22	....	....	....	382	5,480	1,406	208	42	100	122	135	....	
23	....	....	....	382	5,805	1,476	178	34	100	178	148	....	
24	....	....	....	666	5,025	1,583	135	34	111	178	148	....	
25	....	....	....	585	4,915	1,733	122	20	100	178	148	....	
26	....	....	....	585	5,245	1,583	178	20	100	178	148	....	
27	....	....	....	639	4,585	1,441	178	20	122	208	122	....	
28	....	....	....	639	3,395	1,406	163	34	111	420	122	....	
29	....	....	....	867	3,635	1,208	122	57	82	306	135	....	
30	....	....	....	991	4,482	1,208	122	148	91	272	122	....	
31	....	....	....	....	5,480	....	223	178	....	238	....	....	
Total	....	....	....	15,785	100,597	87,406	12,416	2,359	2,298	4,890	4,650	....	Period
Mean	....	....	....	526	3,245	2,914	401	76	77	158	152	....	944
Maximum	....	....	....	991	6,135	5,480	1,115	272	122	420	223	....	6,135
Minimum	....	....	....	193	778	1,208	122	20	20	82	100	....	122
Run-off per square mile	....	....	....	0.407	2.508	2.252	0.310	0.059	0.060	0.122	0.117	....	0.730
Run-off, depth, inches	....	....	....	0.454	2.892	2.512	0.357	0.068	0.067	0.141	0.130	....	6.621
Run-off, acre-feet	....	....	....	31,310	199,534	173,370	24,627	4,679	4,561	9,699	9,223	....	457,003
Acre-feet per square mile	....	....	....	24.20	154.20	133.98	19.03	3.62	3.52	7.48	7.12	....	353.15

SOUTH FORK LITTLE SNAKE RIVER AT GARDNER'S RANCH

This station was established May 8, 1912, in co-operation with The Elk River Irrigation & Construction Company, and is located ten miles above Battle Creek post office at Gardner's ranch.

The equipment consists of a Bristol automatic gauge and a staff gauge.

The section is composed of cobblestones, and is permanent.

The observer is Ed Turner, whose salary is $3.75 per month, which is paid by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF SOUTH FORK LITTLE SNAKE RIVER AT GARDNER'S RANCH

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 May 8	C. L. Chatfield	26	3.50	1.41	91
May 31	C. L. Chatfield	46	5.04	2.22	232
June 19	W. P. Finley	26	3.50	1.47	91
July 31	W. P. Finley	14	1.00	1.03	14

DISCHARGE OF SOUTH FORK LITTLE SNAKE RIVER AT GARDNER'S RANCH FOR 1912

Drainage Area, 46 Square Miles. Altitude, 7,000 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						210	62	30	3	8			
2						200	62	24	2	8			
3						210	62	17	2	8			
4						210	62	12	2	8			
5						200	62	8	3	17			
6						190	54	8	3	12			
7						200	38	8	3	12			
8					143	210	30	8	2	17			
9					161	200	30	8	2	17			
10					170	170	30	6	6	17			
11					152	161	30	3	8	17			
12					134	152	30	3	6	17			
13					107	143	30	3	3	8			
14					107	143	46	3	8	8			
15					143	134	30	6	8	12			
16					180	116	24	8	8	12			
17					210	107	24	6	8	12			
18					240	98	17	6	8	12			
19					250	98	30	6	8	12			
20					260	98	30	3	8	17			
21					280	98	24	3	6	12			
22					250	89	17	3	8	30			
23					250	80	24	3	6	17			
24					250	80	17	3	8	24			
25					250	80	17	1	8	24			
26					250	80	17	1	8	30			
27					220	80	24	2	12				
28					200	80	17	3	8				
29					200	71	12	6	8				
30					220	71	30	12	6				
31					230		30	12					
Total					4,857	4,059	1,012	225	179	388			Period
Mean					202	135	33	7	6	15			62
Maximum					280	210	62	30	12	30			280
Minimum					107	71	12	1	2	8			1
Run-off per square mile					4.398	2.935	0.717	0.158	0.130	0.326			1.348
Run-off, depth, inches					3.925	3.275	0.827	0.182	0.145	0.316			8.670
Run-off, acre-feet					9,634	8,051	2,007	446	355	770			21,263
Acre-feet per square mile					209.41	175.02	43.63	9.70	7.72	16.75			462.23

SLATER CREEK NEAR SLATER

This station was established in 1910, and is located on private road bridge three miles from Slater post office.

The equipment consists of a staff gauge bolted to left abutment of bridge. Measurements are made from a bridge one mile below during high water.

The bed of the stream is composed of cobblestones and is permanent.

The observer is H. V. Rowell, whose salary is $5.00 per month.

Sufficient measurements have been made at this station during high stages to justify a recomputation of results published in the Fifteenth Biennial Report, and the daily discharge is republished.

DISCHARGE MEASUREMENTS OF SLATER CREEK NEAR SLATER

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 13*	C. L. Chatfield	18	1.22	....	22
May 26	C. L. Chatfield	138	3.52	2.90	486
June 26	C. L. Chatfield	89	1.33	1.91	118
Sept. 25	C. L. Chatfield	14	0.60	1.10	9
1912 Feb. 13*	C. L. Chatfield	9	2.09	....	19
May 6	C. L. Chatfield	77	0.94	1.70	72

*Ice conditions.

DISCHARGE OF SLATER CREEK NEAR SLATER FOR 1910

Drainage Area, 143 Square Miles. Altitude, 6,650 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						490	37	20	8	12		20	
2						465	37	15	8	15		20	
3						440	37	15	8	31		25	
4						345	37	12	37			20	
5						305	37	15	25			15	
6						305	25	12	15			12	
7						267	25	8	12			20	
8						248	20	8	12			25	
9						215	20	8	12		25	25	
10						185	20	8	8		20		
11						170	15	8	8		20		
12						170	15	6	8		20		
13						170	15	8	8		20		
14						185	15	8	37		25		
15						142	12	8	15		25		
16						131	15	8	12		20		
17						142	12	6	12		20		
18						120	25	5	12		20		
19						100	20	5	15		20		
20						82	15	5	15		8		
21						82	15	8	15		25		
22						65	12	8	15		20		
23						65	12	8	15		20		
24						50	12	8	15		25		
25						50	4	8	15		25		
26						50	2	6	12		25		
27						37	4	6	12		20		
28					515	37	2	6	12		20		
29					515	37	50	6	12		25		
30					540	58	50	8	12		25		
31					490		15	8					
Total					2,060	5,208	632	266	422	58	473	182	Period
Mean					515	174	20	9	14	19	22	20	58
Maximum					540	490	37	20	37	31	25	25	540
Minimum					490	37	2	5	8	12	8	12	2
Run-off per square mile					3.601	1.217	0.140	0.063	0.098	0.133	0.154	0.140	0 106
Run-off, depth, inches					0.536	1.358	0.161	0.073	0.109	0.015	0.126	0.047	2.425
Run-off, acre-feet					4,086	10,330	1,254	528	837	115	938	361	18,449
Acre-feet per square mile					28.57	72.24	8.77	3.69	5.85	0.80	6.56	2.52	129.00

DISCHARGE OF SLATER CREEK NEAR SLATER FOR 1911

Drainage Area, 143 Square Miles. Altitude, 6,650 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1			20	58	230	515	82	12	6	120			
2			20	65	200	540	82	12	6	131			
3			20	74	200	465	74	8	8	100			
4			20	100	305	490	74	8	15	100			
5			20	74	490	568	65	8	12	170			
6			20	58	770	568	50	8	12	170			
7			20	50	880	665	50	8	12	100			
8			20	31	910	710	50	8	8	58			
9			20	50	1,022	540	44	6	8	50			
10			20	58	770	345	37	6	8	44			
11			15	58	465	305	37	6	8	44			
12			15	65	490	325	25	6	8	37			
13			15	58	798	345	25	6	8	37			
14			15	44	655	345	15	6	15	37			
15			15	25	798	325	15	5	12	44			
16			15	25	740	568	15	5	8	37			
17			15	25	740	465	20	5	8	37			
18			15	37	625	325	20	5	8	37			
19			25	65	368	368	15	5	8	44			
20			25	82	305	286	15	5	8	44			
21			37	100	305	325	15	5	8	44			
22			50	110	368	230	15	5	8	44			
23			50	142	490	200	20	8	15	50			
24			50	170	368	170	20	8	12	44			
25			44	185	490	142	20	5	12	44			
26			37	200	490	120	15	5	15	44			
27			37	267	440	100	15	5	20	44			
28			31	368	390	100	15	5	25	37			
29			31	440	415	91	15	5	25	31			
30			37	305	490	82	12	5	31	25			
31			50		540		12	6		25			
Total			824	3,389	16,547	10,613	984	200	357	1,873			Period
Mean			27	113	534	354	32	6.5	12	60			142
Maximum			50	440	1,022	710	82	12	31	170			1,022
Minimum			15	25	200	82	12	5	6	25			6
Run-off per square mile			0.189	0.790	3.734	2.476	0.224	0.046	0.084	0.420			0.993
Run-off, depth, inches			0.218	0.881	4.305	2.762	0.258	0.053	0.094	0.484			9.048
Run-off, acre-feet			1,634	6,722	32,820	21,050	1,952	397	708	3,715			68,998
Acre-feet per square mile			11.43	47.00	229.51	147.20	13.65	2.78	4.95	25.98			482.50

DISCHARGE OF SLATER CREEK NEAR SLATER FOR 1912

Drainage Area, 148 Square Miles. Altitude, 6,650 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1				1	120								
2				2	131								
3				2	74								
4				4	110								
5				5	120								
6				8	82								
7				8	185								
8				12	390								
9				15	440								
10				15	390								
11				20	345								
12				20	390								
13				25	305								
14				25	156								
15				31	286								
16				31	595								
17				31	1,022								
18				37	1,248								
19				37	1,700								
20				44	1,365								
21				44	1,365								
22				50	1,165								
23				50	1,192								
24				58	1,220								
25				100	1,395								
26				82									
27				82									
28				65									
29				100									
30				65									
31													
Total				1,069	15,791								Period
Mean				36	632								307
Maximum				100	1,700								1,700
Minimum				1	74								1
Run-off per square mile				0.252	4.419								2.147
Run-off, depth, inches				0.281	4.109								4.390
Run-off, acre-feet				2,120	31,322								33,442
Acre-feet per square mile				14.82	219.03								233.85

SLATER CREEK AT BAXTER'S RANCH NEAR SLATER

This station, established May 6, 1912, is located on a private bridge at Baxter's ranch ten miles above Slater post office, and is maintained in co-operation with The Elk River Irrigation & Construction Company.

The equipment consists of a Bristol automatic gauge and auxiliary staff gauge, owned by The Elk River Irrigation Construction Company.

The channel, composed of boulders, is rough but permanent. The current is very swift at high water.

The observer is F. D. Baxter, whose salary, $5.00 per month, is paid by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF SLATER CREEK AT BAXTER'S RANCH

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 May 6	C. L. Chatfield	46	1.37	1.80	63
June 20	W. P. Finley	88	3.13	2.68	275
Aug. 1	C. L. Chatfield	54	0.82	1.60	44

DISCHARGE OF SLATER CREEK AT BAXTER'S RANCH FOR 1912

Drainage Area, 80 Square Miles. Altitude, 7,000 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						290	201	46	13				
2						332	188	30	7				
3						360	165	21	7				
4						416	143	17	7				
5						402	154	13	7				
6					88	388	132	13	7				
7					121	416	132	13	7				
8					188	444	121	13	6				
9					226	402	99	13	7				
10					251	346	88	13	10				
11					251	332	78	10	10				
12					264	318	88	10	7				
13					214	276	110	10	7				
14					201	276	176	7	21				
15					238	238	110	21	17	30			
16					360	188	78	30	13	21			
17					492	176	53	21	35	26			
18					572	188	46	21	17	26			
19					626	214	61	17	13	26			
20					706	264	88	10	13	26			
21					685	290	53	7	13	26			
22					608	304	46	7	13	30			
23					590	290	53	7	17	30			
24					644	276	35	7	21	30			
25					664	290	30	7	17	30			
26					626	290	35	6	17	30			
27					508	276	40	10	17	26			
28					492	264	35	13	17	26			
29					556	251	26	26	17	26			
30					556	214	35	40	13	26			
31					374		46	30		26			
Total					11,101	9,011	2,745	509	393	461			Period
Mean					427	300	89	16	13	27			147
Maximum					706	441	201	46	35	30			706
Minimum					88	176	26	6	6	21			6
Run-off per square mile					5.338	3.750	1.112	0.200	0.162	0.338			1.838
Run-off, depth, inches					5.162	4.184	1.282	0.231	0.181	0.214			1.254
Run-off, acre-feet					22,015	17,874	5,444	1,010	779	914			48,036
Acre-feet per square mile					275.19	223.42	68.05	12.62	9.74	11.42			600.44

MIDDLE FORK LITTLE SNAKE RIVER AT GARDNER'S RANCH

This station was established May 8, 1912, on the county road bridge ten miles above Battle Creek post office. It is maintained in co-operation with The Elk River Irrigation & Construction Company.

The equipment consists of a Bristol automatic gauge and auxiliary staff gauge owned by The Elk River Irrigation & Construction Company.

The bed of the stream is composed of cobblestones and is permanent.

The observer is Ed Turner, who is paid $3.75 per month by The Elk River Irrigation & Construction Company.

DISCHARGE MEASUREMENTS OF MIDDLE FORK LITTLE SNAKE RIVER AT GARDNER'S RANCH

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1912 May 8	C. L. Chatfield	71	3.07	1.94	218
May 30	C. L. Chatfield	199	7.74	5.35	1,540
June 16	W. P. Finley	90	3.52	2.30	317
July 31	W. P. Finley	47	1.70	1.28	80

DISCHARGE OF MIDDLE FORK LITTLE SNAKE RIVER AT GARDNER'S RANCH FOR 1912

Drainage Area, 152 Square Miles. Altitude, 7,000 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1						1,117	209	62	16	19			
2						1,162	198	56	12	19			
3						1,285	174	36	10	19			
4						1,310	163	28	10	19			
5						1,186	163	22	10	25			
6						1,117	140	22	10	25			
7						1,094	130	22	10	28			
8					300	1,072	120	25	10	25			
9					356	1,027	100	22	10	28			
10					371	880	100	22	32	28			
11					342	777	92	19	22	28			
12					328	684	100	16	16	32			
13					274	666	100	16	16	25			
14					287	648	163	16	25	22			
15					356	563	100	19	22	22			
16					497	464	76	28	22	22			
17					740	386	62	22	32	22			
18					1,072	342	56	22	36	22			
19					1,162	313	83	19	28	22			
20					1,236	313	100	16	28	28			
21					1,410	328	62	12	22	25			
22					1,260	342	56	12	22	22			
23					1,260	328	62	12	22	32			
24					1,360	328	45	10	28	32			
25					1,460	342	45	10	22	32			
26					1,360	328	56	9	28	40			
27					1,072	287	62	10	28				
28					920	274	56	12	25				
29					1,162	261	36	16	22				
30					1,360	248	45	36	19				
31					1,360		83	28					
Total					21,305	19,472	3,037	677	615	663			Period
Mean					888	649	98	22	20	26			266
Maximum					1,460	1,310	209	62	36	40			1,460
Minimum					274	248	36	9	10	19			9
Run-off per square mile					5.842	4.270	0.645	0.143	0.135	0.171			1.750
Run-off, depth, inches					5.214	4.764	0.744	0.165	0.151	0.166			11.204
Run-off, acre-feet					42,258	38,623	6,024	1,343	1,220	1,315			90,787
Acre-feet per square mile					278.02	254.10	39.63	8.83	8.03	8.65			597.26

WHITE RIVER AT MEEKER

This station, maintained by the State, is located on a private bridge at Van Cleave's ranch one-half mile above Meeker, and was first established in 1901, by the United States Geological Survey.

The equipment consists of a Bristol automatic gauge and auxiliary staff gauge.

The channel is composed of cobblestones and conditions are good.

The observer is Walter Van Cleave, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF WHITE RIVER AT MEEKER

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 7	C. L. Chatfield	172	1.98	0.95	340
May 22	C. E. Turner	287	4.08	1.90	1,172
July 1	C. L. Chatfield	251	3.44	1.57	864
July 3	C. L. Chatfield	251	3.33	1.57	837
July 8	C. L. Chatfield	243	2.79	1.42	679
Aug. 17	C. L. Chatfield	178	1.90	0.93	339
Aug. 18	C. L. Chatfield	181	2.03	0.98	368
Aug. 19	C. L. Chatfield	179	1.87	0.93	334
Aug. 22	Chatfield & Ault	184	2.02	1.00	372
Oct. 12	C. L. Chatfield	91	2.28	1.10	437
Oct. 19	C. L. Chatfield	184	2.10	1.03	386
1912 Feb. 6*	C. L. Chatfield	116	....	....	252
Apr. 17	C. L. Chatfield	186	2.23	1.00	415
June 4	C. L. Chatfield	422	8.93	3.75	3,768
June 7	C. L. Chatfield	480	8.40	3.95	4,032
June 12	C. L. Chatfield	472	7.89	3.80	3,724
Aug. 7	C. L. Chatfield	204	2.58	1.24	526

*Ice conditions.

DISCHARGE OF WHITE RIVER AT MEEKER FOR 1911

Drainage Area, 634 Square Miles. Altitude, 6,182 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	322	275	405	295	470	870	1,805	770	325	325	470	435	....	
2	322	275	325	295	470	820	1,945	770	295	325	375	405	....	
3	355	275	375	375	470	770	2,000	820	275	350	405	435	....	
4	355	275	350	435	505	870	2,000	820	295	405	375	435	....	
5	292	295	350	470	545	1,280	2,065	770	275	375	630	405	....	
6	322	325	350	470	505	1,620	2,365	675	275	350	870	375	....	
7	338	275	350	470	470	1,620	2,435	675	295	325	630	435	....	
8	355	295	325	435	435	1,805	2,775	675	275	325	470	545	....	
9	355	295	375	505	470	2,365	3,030	630	295	325	435	545	....	
10	355	295	470	545	505	2,198	2,545	585	275	295	405	505	....	
11	355	295	435	505	505	1,560	2,198	585	295	295	375	470	....	
12	322	295	375	325	470	1,445	2,198	545	275	275	405	435	....	
13	307	295	325	275	375	1,620	2,198	505	295	295	435	435	....	
14	322	325	350	325	405	1,680	2,065	505	295	325	435	435	....	
15	322	325	325	295	350	1,805	2,000	470	325	325	435	435	....	
16	322	325	275	325	435	1,390	2,000	435	325	325	435	435	....	
17	322	325	350	375	375	1,560	1,805	405	325	275	405	435	....	
18	322	325	350	325	375	1,560	1,740	405	325	275	405	405	....	
19	338	350	350	295	470	1,620	1,805	375	325	275	375	405	....	
20	392	375	295	325	585	1,390	1,740	375	325	275	405	405	....	
21	355	375	275	325	675	1,170	1,945	375	350	260	375	405	....	
22	355	350	295	375	675	1,120	1,740	405	375	275	405	435	....	
23	392	375	295	375	675	1,225	1,560	470	375	275	505	405	....	
24	374	375	350	375	770	1,445	1,390	375	375	275	470	405	....	
25	355	375	295	375	770	1,445	1,280	375	375	275	435	405	....	
26	307	375	275	295	870	1,560	1,070	375	375	275	435	405	....	
27	292	375	275	275	920	1,390	1,020	375	350	325	435	405	....	
28	322	375	275	325	1,120	1,390	920	375	325	325	435	405	....	
29	322	375	....	325	1,170	1,445	820	375	325	325	405	405	....	
30	292	505	....	350	970	1,500	628	350	325	375	405	405	....	
31	322	505	....	435	....	1,740	....	325	325	....	435	....	....	
Total	10,383	10,475	9,440	11,495	17,805	45,278	55,087	15,970	9,865	9,325	13,915	12,855	....	Period 1911
Mean	335	338	337	371	594	1,461	1,836	515	318	311	449	428	....	633
Maximum	392	505	470	545	1,170	2,365	3,030	820	375	405	870	545	....	3,030
Minimum	292	275	275	275	350	770	628	325	275	260	375	405	....	260
Run-off per square mile	0.528	0.533	0.532	0.585	0.937	2.304	2.896	0.812	0.502	0.491	0.708	0.675	....	0.998
Run-off, depth, inches	0.609	0.614	0.554	0.674	1.045	2.656	3.231	0.936	0.579	0.548	0.816	0.753	....	12.406
Run-off, acre-feet	20,594	20,777	18,736	22,800	35,316	89,807	109,263	31,676	19,567	8,496	27,600	25,497	....	419,535
Acre-feet per square mile	32.48	32.77	29.55	35.96	55.70	141.64	172.33	49.96	30.86	29.17	43.54	40.22	....	661.70

DISCHARGE OF WHITE RIVER AT MEEKER FOR 1912

Drainage Area, 634 Square Miles. Altitude, 6,182 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	325	470	470	3,365	2,545	630	405	295	260	....	
2	....	....	325	470	505	3,285	2,435	585	375	295	325	....	
3	....	....	325	505	505	3,610	2,065	545	375	295	325	....	
4	....	....	325	545	585	3,610	1,870	505	350	295	275	....	
5	....	....	350	505	470	3,780	1,680	505	350	325	260	....	
6	....	....	405	470	435	3,950	1,500	505	325	295	275	....	
7	....	....	435	435	585	3,950	1,500	505	295	350	245	....	
8	....	....	435	435	628	4,290	1,560	505	295	325	325	....	
9	....	....	375	470	870	4,650	1,500	505	295	325	405	....	
10	....	....	470	470	970	4,290	1,390	470	325	325	350	....	
11	....	....	435	405	970	4,120	1,280	470	325	325	435	....	
12	....	....	405	405	870	3,610	1,280	435	295	325	325	....	
13	....	....	375	375	770	3,365	1,335	405	325	325	245	....	
14	....	....	375	325	628	3,050	1,280	405	375	325	275	....	
15	....	....	375	325	770	2,755	1,225	435	375	350	275	....	
16	....	....	375	325	1,020	2,435	1,170	505	325	325	260	....	
17	....	....	350	375	1,620	1,945	1,020	470	325	325	245	....	
18	....	....	470	350	1,945	1,680	920	405	325	325	275	....	
19	....	....	585	375	2,365	1,500	920	375	325	350	325	....	
20	....	375	630	375	2,405	1,560	970	405	325	375	350	....	
21	....	375	470	350	3,125	1,805	820	470	325	435	350	....	
22	....	375	435	350	3,050	2,000	770	435	325	350	295	....	
23	....	375	435	325	3,125	2,365	770	405	295	435	375	....	
24	....	375	375	325	3,365	2,365	675	405	325	375	350	....	
25	....	350	435	350	3,610	2,435	675	375	325	375	325	....	
26	....	325	470	375	3,780	2,365	770	375	325	375	325	....	
27	....	325	505	375	3,610	2,545	870	405	325	405	375	....	
28	....	325	545	350	2,900	2,685	870	470	325	505	435	....	
29	....	325	630	375	3,125	2,545	728	435	295	375	295	....	
30	....	....	585	435	3,610	2,545	675	545	295	350	295	....	
31	....	....	505	....	4,205	....	630	505	....	325	....	....	
Total	....	3,525	13,535	12,020	56,891	88,455	37,698	14,395	9,870	10,780	9,475	....	Period
Mean	....	352	437	401	1,835	2,948	1,216	464	329	348	316	....	900
Maximum	....	375	630	545	4,205	4,650	2,545	630	405	505	435	....	4,650
Minimum	....	325	325	325	435	1,500	630	375	295	295	245	....	245
Run-off per square mile	....	0.555	0.689	0.632	2.894	4.650	1.918	0.732	0.519	0.549	0.498	....	1.420
Run-off, depth, inches	....	0.206	0.794	0.705	3.337	5.188	2.211	0.844	0.579	0.633	0.556	....	15.053
Run-off, acre-feet	....	6,992	26,846	23,842	112,843	175,450	74,774	28,552	19,578	21,382	18,794	....	509,054
Acre-feet per square mile	....	11.03	42.34	37.61	178.00	276.74	117.94	45.04	30.88	33.73	29.64	....	802.95

SOUTH FORK WHITE RIVER NEAR BUFORD

This station, now maintained by the State, was first established by the United States Geological Survey in 1903, and is located on a private bridge at Stillwater's ranch six miles above Buford.

The equipment consists of a staff gauge spiked to pier of bridge.

The section is composed of gravel, and is fairly permanent. The left bank overflows at high water.

The observer is George Thomas, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF SOUTH FORK WHITE RIVER NEAR BUFORD

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 6	C. L. Chatfield	75	1.57	0.40	128
May 23	C. E. Turner	205	2.83	2.25	580
July 6	C. L. Chatfield	151	2.68	1.60	405
Aug. 21	Chatfield & Ault	95	1.50	0.50	143
Oct. 22	Chatfield & Alley	99	1.20	0.40	119
1912 Feb. 8†	C. L. Chatfield	72	1.76	....	127
Apr. 19*†	C. L. Chatfield	....	....	0.20	100
June 6	C. L. Chatfield	535	3.15	6.42	1,686
Aug. 9	C. L. Chatfield	106	2.05	0.80	217

*Computed from measurement below forks. †Ice conditions.

DISCHARGE OF SOUTH FORK WHITE RIVER NEAR BUFORD FOR 1911

Drainage Area, 148 Square Miles. Altitude, 7,200 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	90	....	125	90	90	165	1,361	511	186	107	125	....	....	
2	90	....	125	90	107	165	1,469	511	186	107	125	....	....	
3	90	....	125	90	125	165	1,505	511	165	107	165	....	....	
4	90	....	125	90	90	208	1,579	484	165	107	231	....	....	
5	90	....	125	90	125	255	1,764	457	144	107	279	....	....	
6	90	....	125	90	125	327	1,801	430	144	107	279	....	....	
7	90	....	125	90	125	430	1,991	404	144	107	255	....	....	
8	90	....	107	90	144	595	2,077	378	144	107	144	....	....	
9	90	....	107	90	144	595	2,153	378	144	107	125	....	....	
10	90	....	107	90	144	457	1,991	352	125	107	125	....	....	
11	90	....	107	90	144	430	1,653	352	125	107	125	....	....	
12	90	....	90	90	144	457	1,801	327	125	107	125	....	....	
13	90	....	90	90	144	457	1,505	327	125	107	125	....	....	
14	90	....	90	90	90	457	1,433	327	125	107	125	....	....	
15	90	....	90	90	90	430	1,433	303	125	107	125	....	....	
16	90	....	107	75	90	457	1,433	303	107	107	125	....	....	
17	90	....	107	75	90	567	1,433	255	107	107	125	....	....	
18	80	....	107	90	144	624	1,433	255	90	107	125	....	....	
19	80	....	107	90	144	807	1,469	255	90	107	125	....	....	
20	80	....	107	90	144	807	1,183	255	90	107	125	....	....	
21	80	....	125	90	144	624	1,361	255	144	107	125	....	....	
22	80	....	125	90	165	511	1,325	255	125	107	125	....	....	
23	80	....	125	90	165	595	1,077	255	107	107	125	....	....	
24	80	....	125	90	165	624	1,041	255	90	107	125	....	....	
25	80	....	125	90	165	872	1,006	255	125	107	125	....	....	
26	80	....	125	90	186	972	1,006	255	125	107	125	....	....	
27	80	....	125	90	208	972	972	255	125	107	125	....	....	
28	80	....	90	90	231	1,077	905	255	125	107	125	....	....	
29	80	....	....	90	255	1,077	807	231	125	107	125	....	....	
30	80	....	....	90	231	1,148	511	208	125	107	125	....	....	
31	80	....	....	90	....	1,325	....	208	125	....	125	....	....	
Total	2,650	....	3,163	2,760	4,358	18,652	42,478	10,062	3,997	3,210	4,478	....	....	Period 1911
Mean	85	....	113	89	145	602	1,416	325	129	107	144	....	....	341
Maximum	90	....	125	90	255	1,325	2,153	511	186	107	279	....	....	2,153
Minimum	80	....	90	75	90	165	511	208	90	107	125	....	....	75
Run-off per square mile	0.574	....	0.763	0.601	0.980	4.067	9.568	2.196	0.872	0.723	0.973	....	....	2.304
Run-off, depth, inches	0.661	....	0.794	0.693	1.093	4.689	10.675	2.532	1.005	0.807	1.122	....	....	23.410
Run-off, acre-feet	5,256	....	6,274	5,474	8,644	36,996	84,254	19,958	7,928	6,367	8,882	....	....	184,777
Acre-feet per square mile	35.51	....	42.39	36.98	58.40	249.97	569.25	134.84	53.57	43.02	60.01	....	....	1,248.47

DISCHARGE OF SOUTH FORK WHITE RIVER NEAR BUFORD FOR 1912

Drainage Area, 148 Square Miles. Altitude, 7,200 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	90	110	194	1,379	1,343	283	152	131	120	....	
2	....	....	90	110	194	1,490	1,200	283	152	131	120	....	
3	....	....	110	110	131	1,605	1,130	260	131	131	120	....	
4	....	....	110	110	131	1,848	1,060	260	131	131	120	....	
5	....	....	90	110	131	2,190	1,026	228	131	131	120	....	
6	....	....	90	110	131	2,154	959	228	131	131	120	....	
7	....	....	90	110	173	2,154	894	228	131	131	120	....	
8	....	....	90	110	152	2,200	894	216	131	131	120	....	
9	....	....	90	110	152	2,340	862	216	131	131	120	....	
10	....	....	90	90	216	2,436	831	216	131	131	120	....	
11	....	....	110	90	194	2,436	800	216	131	131	120	....	
12	....	....	110	90	173	2,246	769	216	131	131	120	....	
13	....	....	90	90	194	2,109	738	216	131	131	120	....	
14	....	....	90	90	194	1,976	678	194	131	131	120	....	
15	....	....	90	90	216	1,890	649	194	131	131	131	....	
16	....	....	90	90	216	1,806	620	194	131	131	131	....	
17	....	....	90	90	260	1,235	564	194	131	131	142	....	
18	....	....	90	90	306	831	510	194	131	131	142	....	
19	....	....	110	90	456	800	483	194	131	131	142	....	
20	....	....	110	90	537	959	456	194	131	131	152	....	
21	....	....	90	90	564	1,130	430	194	131	131	152	....	
22	....	....	90	90	620	1,343	404	173	131	120	142	....	
23	....	....	90	90	620	1,416	379	173	131	120	142	....	
24	....	....	90	110	800	1,566	404	173	131	120	142	....	
25	....	....	90	110	831	1,605	379	173	131	120	142	....	
26	....	....	90	90	862	1,684	379	173	131	120	142	....	
27	....	....	90	110	894	1,806	379	173	131	120	142	....	
28	....	....	90	152	959	1,806	354	173	131	120	142	....	
29	....	....	90	173	1,060	1,605	330	173	131	120	142	....	
30	....	....	110	194	1,130	1,490	330	152	131	120	142	....	
31	....	....	110	....	1,271	....	306	152	....	120	....	....	
Total	....	....	2,950	3,189	13,962	51,535	20,540	6,306	3,972	3,951	3,950	....	Period
Mean	....	....	95	106	450	1,718	662	203	132	127	132	....	401
Maximum	....	....	110	194	1,271	2,436	1,343	283	152	131	152	....	2,436
Minimum	....	....	90	90	131	800	306	152	131	120	120	....	90
Run-off per square mile	....	....	0.642	0.716	3.041	11.608	4.476	1.372	0.892	0.858	0.892	....	2.709
Run-off, depth, inches	....	....	0.740	0.799	3.506	12.948	5.161	1.582	0.995	0.989	0.995	....	27.715
Run-off, acre-feet	....	....	5,851	6,326	27,693	102,220	40,741	12,508	7,879	7,837	7,835	....	218,889
Acre-feet per square mile	....	....	39.53	42.74	187.11	690.67	275.28	84.51	53.24	52.95	52.94	....	1,478.98

NORTH FORK WHITE RIVER NEAR BUFORD

This station, now maintained by the State, was first established by the United States Geological Survey in 1903, about six miles above present location at Genier's ranch, one and one-half miles above Buford.

The equipment consists of staff gauge spiked to supports of foot-bridge from which measurements are made.

The section is composed of cobblestones and boulders with a little gravel and is permanent.

The right bank is low and overflows at high water.

The observer is Mrs. H. Genier, whose salary is $5.00 per month.

DISCHARGE MEASUREMENTS OF NORTH FORK WHITE RIVER NEAR BUFORD

DATE	HYDROGRAPHER	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gauge Height Feet	Discharge Cu. Ft. Per Sec.
1911 Feb. 6........	C. L. Chatfield............................	80	2.38	0.72	190
May 23........	C. E. Turner............................	126	4.83	2.00	609
July 5........	C. L. Chatfield............................	107	3.71	1.40	397
Aug. 20........	C. L. Chatfield............................	84	2.87	0.91	241
Oct. 21........	Chatfield & Alley............................	78	2.46	0.78	192
1912 Feb. 7........	C. L. Chatfield............................	79	2.30	0.70	182
Apr. 18........	C. L. Chatfield............................	77	2.48	0.87	191
June 6........	C. L. Chatfield............................	182	8.58	3.00	156
Aug. 10........	C. L. Chatfield............................	109	3.46	1.35	377

DISCHARGE OF NORTH FORK WHITE RIVER NEAR BUFORD FOR 1911

Drainage Area, 240 Square Miles. Altitude, 7,000 Feet Above Sea Level.

DAY	Dec. 1910	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	....	....	190	187	220	408	836	488	262	220	315	208	208	
2	....	....	190	187	233	408	836	468	248	220	280	208	208	
3	....	....	190	187	248	428	813	448	233	233	280	198	352	
4	....	....	190	187	262	592	836	448	233	233	233	198	208	
5	....	....	198	187	248	790	836	408	233	220	468	208	208	
6	....	....	198	187	233	931	836	408	233	208	3[illegible]5	208	208	
7	....	....	198	187	208	907	860	408	233	208	280	208	208	
8	....	....	208	187	220	1,080	1,130	370	233	208	280	208	233	
9	....	....	220	198	220	1,130	1,030	370	233	208	262	208	220	
10	....	....	208	198	233	956	883	370	233	208	248	220	220	
11	....	....	208	208	233	700	860	333	233	208	233	220	220	
12	....	....	198	187	220	700	813	333	248	208	220	220	198	
13	....	....	198	198	198	790	836	333	233	233	208	220	187	
14	....	....	187	208	198	883	813	333	233	220	208	233	187	
15	....	....	187	187	208	931	790	315	233	208	208	233	187	
16	....	....	187	187	208	883	860	297	233	208	208	233	187	
17	....	....	198	198	198	883	790	297	233	208	208	220	187	
18	....	....	208	187	220	813	790	297	233	208	208	233	178	
19	....	....	208	198	248	790	790	297	233	208	208	220	198	
20	....	....	208	198	297	656	722	297	233	208	1[illegible]8	233	233	
21	....	....	208	208	333	656	836	297	262	208	208	220	233	
22	....	....	208	187	370	592	745	448	233	198	208	208	220	
23	....	....	208	208	428	656	722	315	233	198	208	208	233	
24	....	....	208	208	448	678	656	297	233	198	208	208	233	
25	....	....	198	208	448	768	592	297	233	198	208	208	220	
26	....	....	198	187	488	768	550	297	233	208	208	208	220	
27	....	....	187	198	571	722	529	297	233	208	208	208	220	
28	....	....	187	187	656	613	488	297	220	208	198	198	220	
29	....	....	....	187	634	634	448	297	220	220	198	198	220	
30	....	....	....	198	488	678	448	262	220	315	187	208	208	
31	....	....	....	198	....	745	....	262	220	....	208	....	208	
Total	....	....	5,579	6,022	9,417	23,169	22,974	10,684	7,259	6,430	7,315	6,409	6,690	Period 1911
Mean	....	....	199	194	314	747	766	345	234	214	236	214	215	478
Maximum	....	....	220	208	656	1,130	1,130	488	262	315	468	233	352	1,130
Minimum	....	....	187	187	198	408	448	262	220	198	187	198	178	178
Run-off per square mile	....	....	0.829	0.808	1.308	3.112	3.192	1.437	0.975	0.892	0.983	0.892	0.896	1.992
Run-off, depth, inches	....	....	0.863	0.932	1.460	3.588	3.561	1.657	1.124	0.995	1.133	0.995	1.033	17.341
Run-off, acre-feet	....	....	11,066	11,944	18,678	45,955	45,568	21,191	14,398	12,754	14,509	12,712	13,230	222,005
Acre-feet per square mile	....	....	46.11	49.77	77.83	191.48	189.87	88.30	60.00	53.14	60.46	52.97	55.13	925.05

DISCHARGE OF NORTH FORK WHITE RIVER NEAR BUFORD FOR 1912

Drainage Area, 240 Square Miles. Altitude, 7,000 Feet Above Sea Level.

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	210	200	190	190	315	2,305	1,275	525	300	260	222	....	
2	222	210	190	190	315	2,625	1,275	480	285	248	248	....	
3	222	200	190	200	300	2,970	1,075	480	285	248	248	....	
4	248	200	190	200	315	2,230	900	460	285	248	248	....	
5	260	200	190	210	300	1,680	940	420	285	248	248	....	
6	260	180	190	210	285	1,940	900	400	272	248	272	....	
7	248	190	190	210	315	1,680	900	400	272	272	248	....	
8	222	190	190	200	440	1,560	825	362	272	248	248	....	
9	248	190	190	210	525	1,620	825	362	272	248	248	....	
10	248	190	190	210	480	1,620	860	362	272	260	248	....	
11	248	190	190	222	500	1,330	825	345	272	260	248	....	
12	272	190	190	222	440	985	755	330	272	260	248	....	
13	272	190	190	222	420	900	720	330	285	260	248	....	
14	260	190	190	210	440	790	690	330	330	260	248	....	
15	248	190	190	210	500	1,275	690	345	330	260	248	....	
16	272	190	190	235	720	1,075	690	400	300	248	235	....	
17	248	190	190	235	1,220	985	660	330	272	248	222	....	
18	260	190	190	235	1,560	900	630	330	272	248	222	....	
19	222	190	190	235	1,745	900	630	330	272	248	222	....	
20	222	190	190	235	2,080	900	600	330	260	248	222	....	
21	235	190	190	222	2,155	985	600	315	260	248	222	....	
22	222	190	190	210	2,230	900	550	315	248	248	222	....	
23	210	200	190	210	2,155	985	550	315	248	248	235	....	
24	210	190	200	210	2,305	1,170	550	300	248	248	248	....	
25	210	190	200	235	2,380	1,220	550	300	248	248	235	....	
26	222	190	200	235	3,060	1,170	550	285	260	248	248	....	
27	210	190	190	235	2,540	1,225	525	300	272	248	248	....	
28	190	190	190	248	2,155	1,330	575	300	272	260	248	....	
29	200	190	190	260	2,710	1,275	575	330	272	248	248	....	
30	200	....	200	285	3,150	1,330	525	362	260	248	248	....	
31	210	....	190	....	2,970	....	525	330	....	222	....	....	
Total	7,231	5,570	5,930	6,641	41,025	41,910	22,740	11,103	8,253	7,782	7,243	....	Period
Mean	233	192	191	221	1,323	1,397	733	358	275	251	241	....	494
Maximum	272	210	200	285	3,150	2,970	1,275	525	330	272	272	....	3,150
Minimum	190	180	190	190	285	790	525	285	248	222	222	....	180
Run-off per square mile	0.971	0.800	0.796	0.892	5.513	5.822	3.054	1.492	1.146	1.046	1.003	....	2.058
Run-off, depth, inches	1.120	0.863	0.918	0.995	6.345	6.496	3.521	1.720	1.279	1.206	1.119	....	25.582
Run-off, acre-feet	14,343	11,048	11,762	13,172	81,373	83,128	45,105	22,023	16,369	15,435	14,366	....	328,124
Acre-feet per square mile	59.77	46.04	49.03	54.89	339.05	346.37	187.94	91.77	68.21	64.31	59.86	....	1,367.24

Miscellaneous Measurements

MISCELLANEOUS MEASUREMENTS IN THE SOUTH PLATTE RIVER BASIN IN 1911 AND 1912

Date	Stream	Tributary To	Locality	Gage Height Feet	Discharge Sec. Ft.
Apr. 11, 1911	Cache la Poudre river	South Platte river	Ft. Collins water works	2.00	52
Apr. 26, 1911	Middle Boulder creek	South Platte river	Two miles below North Fork		9.9
Apr. 26, 1911	Middle Boulder creek	South Platte river	Nederland above Beaver creek		24
Apr. 26, 1911	Middle Boulder creek	South Platte river	Above power house		8.9
May 16, 1911	No. Fork Cache la Poudre	South Platte river	St. Cloud		196
Aug. 10, 1911	So. outlet Chamber's lake	Cache la Poudre river	Chamber's lake		36
Aug. 10, 1911	No. outlet Chamber's lake	Cache la Poudre river	Chamber's lake		30
Aug. 10, 1911	Joe Wright creek	Cache la Poudre river	100 feet above mouth		22
Aug. 10, 1911	Fall creek	Cache la Poudre river	200 feet above mouth		10
Aug. 11, 1911	So. outlet Chamber's creek	Cache la Poudre river	Chamber's lake		71
Aug. 11, 1911	No. outlet Chamber's lake	Cache la Poudre river	Chamber's lake		56
Aug. 11, 1911	Joe Wright creek	Cache la Poudre river	100 feet above mouth		78
Aug. 11, 1911	Fall creek	Cache la Poudre river	200 feet above mouth		12
Sept. 15, 1911	Cache la Poudre river	South Platte river	Frye's ranch	2.90	82
Nov. 10, 1911	South Platte river		Below headgate Bijou canal		349
Jan. 4, 1912	No. Fork South Platte	South Platte river	South Platte	2.70	24
Jan. 29, 1912	No. Fork South Platte	South Platte river	South Platte	2.30	33
Apr. 29, 1912	No. Fork South Platte	South Platte river	South Platte	1.85	84
Feb. 27, 1912	No. Fork South Platte	South Platte river	South Platte		33
May 23, 1912	South Platte river		Fort Morgan		85

MISCELLANEOUS MEASUREMENTS IN THE LARAMIE RIVER BASIN IN 1911 AND 1912

Date	Stream	Tributary To	Locality	Gage Height Feet	Discharge Sec. Ft.
May 14, 1911	Big Laramie river		Above mouth McIntyre creek		310
July 7, 1911	Big Laramie river		Lanning Bridge		122
July 9, 1911	Big Laramie river		Gleneyre		233
July 15, 1911	Big Laramie river		Gleneyre		124
July 22, 1911	Big Laramie river		Lanning Bridge		15.2
Aug. 18, 1911	Big Laramie river		Lanning Bridge		5.1
Aug. 18, 1911	Big Laramie river		Gleneyre		42.9
Sept. 17, 1911	Big Laramie river		Lanning Bridge		4.0
July 12, 1911	Little Laramie river		Two Rivers, Wyo.		2.8
July 12, 1911	Big Laramie river		Two Rivers, Wyo.		86.9
July 13, 1911	Big Laramie river		Woods Landing, Wyo.		156
July 16, 1911	Big Laramie river		Lanning Bridge		14
July 20, 1911	Big Laramie river		Woods Landing, Wyo.		205
July 24, 1911	Big Laramie river		100 ft. above mouth Rawah creek		30.8
Aug. 19, 1911	Big Laramie river		Woods Landing, Wyo.		66.8
Aug. 22, 1911	Big Laramie river		Woods Landing, Wyo.		73.3
Aug. 24, 1911	Big Laramie river		Two Rivers, Wyo.		7.2
Aug. 24, 1911	Little Laramie river		Two Rivers, Wyo.		0
Sept. 19, 1911	Big Laramie river		Woods Landing, Wyo.		45.9
Sept. 21, 1911	Big Laramie river		Two Rivers, Wyo.		2.8
Sept. 21, 1911	Little Laramie river		Two Rivers, Wyo.		0
Oct. 11, 1911	Big Laramie river		Inlet to Wheatland res., Wyo.		19.0
Oct. 11, 1911	Big Laramie river		Steel Bridge, Wyo.		20.0
Oct. 12, 1911	Big Laramie river		½ mi. above Gillespie's house, Wyo.		26.5
Oct. 11, 1911	Big Laramie river		400 ft. below pumping plant, Cooper lake		24.3
Oct. 13, 1911	Big Laramie river		Bosler, Wyo.		26.1
Oct. 13, 1911	Big Laramie river		At ford 5 mi. above Bosler, Wyo.		29.2
Oct. 13, 1911	Big Laramie river		10 mi. above Bosler, Wyo.		30.8
Oct. 14, 1911	Big Laramie river		Two Rivers, Wyo.		34.5
Oct. 14, 1911	Big Laramie river		About ½ way between Howell and Two Rivers		28.7
Oct. 14, 1911	Big Laramie river		Five miles above Laramie		28.9
Oct. 16, 1911	Big Laramie river		Upper bridge at Laramie		15.3
Oct. 16, 1911	Big Laramie river		Hart's ranch, Wyo.		14.9
Oct. 16, 1911	Big Laramie river		Near Nelson's road house		16.2
Oct. 16, 1911	Big Laramie river		Riverside ranch		13.7
Oct. 16, 1911	Big Laramie river		Upper bridge at Laramie		22.8
Oct. 17, 1911	Big Laramie river		Above headgate Pioneer ditch		75.5
Oct. 18, 1911	Big Laramie river		Near Jelm, Wyo.		71.8
Oct. 20, 1911	Little Laramie river		Above headgate James lake inlet		22.1
Oct. 20, 1911	Little Laramie river		Four miles below Wrights		31.1
Oct. 22, 1911	Little Laramie river		Below Bath ranch		5.6
May 14, 1911	McIntyre creek	Big Laramie river	Gleneyre		113
July 9, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.65	49.3
July 15, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.50	36.7
July 21, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.45	34.9
Aug. 18, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.14	11.2
Aug. 22, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.21	15.5
Sept. 19, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.09	7.7

MISCELLANEOUS MEASUREMENTS IN THE LARAMIE RIVER BASIN IN 1911 AND 1912—Concluded

Date	Stream	Tributary To	Locality	Gage Height Feet	Discharge Sec. Ft.
Oct. 8, 1911	McIntyre creek	Big Laramie river	Gleneyre	1.28	19.9
July 17, 1911	McIntyre creek	Big Laramie river	Two miles below diversion	....	15
Aug. 21, 1911	McIntyre creek	Big Laramie river	Upper ditch headgate	....	1.7
Sept. 19, 1911	McIntyre creek	Big Laramie river	Upper ditch headgate	....	0.65
July 10, 1911	Johnson creek	Big Laramie river	One mi. n. w. of Boswell's ranch	....	5
July 10, 1911	Beaver creek	Big Laramie river	1½ miles from Boswell's ranch	....	9
July 14, 1911	Grace creek	Big Laramie river	Above mouth	....	12
July 14, 1911	Forrester creek	Big Laramie river	Above mouth	....	0
July 14, 1911	La Garde creek	Big Laramie river	Above mouth	....	10
July 24, 1911	Rawah creek	Big Laramie river	100 feet above mouth	....	34.3
Aug. 18, 1911	Rawah creek	Big Laramie river	200 feet above mouth	....	14.5
Aug. 20, 1911	Grace creek	Big Laramie river	Mouth	....	1.3
Aug. 20, 1911	Forrester creek	Big Laramie river	Mouth	....	0.5
Aug. 22, 1911	La Garde creek	Big Laramie river	Mouth	....	4.6
Sept. 17, 1911	Rawah creek	Big Laramie river	200 feet above mouth	....	7.7
June 21, 1912	McIntyre creek	Big Laramie river	Gleneyre	2.50	178
July 19, 1912	McIntyre creek	Big Laramie river	Gleneyre	2.10	88
Aug. 14, 1912	McIntyre creek	Big Laramie river	Gleneyre	1.40	20
June 21, 1912	Big Laramie river	....	Gleneyre	....	300
July 19, 1912	Big Laramie river	....	Gleneyre	....	254
June 18, 1912	Big Laramie river	....	Laramie, Wyo.	1.70	389
June 19, 1912	Big Laramie river	....	Woods Landing, Wyo.	2.45	807
July 23, 1912	Big Laramie river	....	W. portal of tunnel	....	73
Aug. 15, 1912	Big Laramie river	....	W. portal of tunnel	....	8
Aug. 14, 1912	Big Laramie river	....	Gleneyre	....	68
Sept. 27, 1912	Big Laramie river	....	Gleneyre below McIntyre creek	....	64
Sept. 28, 1912	Rawah creek	Big Laramie river	Mouth of canon	....	6.8
Sept. 28, 1912	Big Laramie river	....	1½ miles above Rawah creek	....	13.6

MISCELLANEOUS MEASUREMENTS IN THE YAMPA RIVER BASIN IN 1911 AND 1912

Date	Stream	Tributary To	Locality	Gage Height Feet	Discharge Sec. Ft.
May 16, 1911	Fish creek	Yampa river	Steamboat Springs	2.00	328
June 12, 1911	Fish creek	Yampa river	Steamboat Springs	2.50	638
July 19, 1911	Fish creek	Yampa river	Steamboat Springs	0.90	35
Aug. 31, 1911	Fish creek	Yampa river	Steamboat Springs	0.05	1.4
May 24, 1912	Fish creek	Yampa river	Steamboat Springs	1.90	221
June 26, 1912	Fish creek	Yampa river	Steamboat Springs	3.60	643
Feb. 16, 1912	Soda creek	Yampa river	Steamboat Springs	....	4.5
Apr. 6, 1912	Soda creek	Yampa river	Steamboat Springs	....	17.6
June 26, 1912	Soda creek	Yampa river	Steamboat Springs	....	297
Apr. 10, 1912	Soda creek	Yampa creek	Steamboat Springs	....	53
Aug. 28, 1912	Soda creek	Yampa river	Steamboat Springs	....	6
June 11, 1911	Mad creek	Elk river	Steamboat Springs	....	500
July 23, 1911	Mad creek	Elk river	Steamboat Springs	....	68
Sept. 18, 1911	Mad creek	Elk river	Steamboat Springs	....	6
May 25, 1911	Four Mile creek	Little Snake river	Dixon road bridge	....	14
May 27, 1911	Four Mile creek	Little Snake river	Dixon road bridge	....	8
June 26, 1911	Four Mile creek	Little Snake river	Dixon road bridge	....	4
Sept. 24, 1911	Four Mile creek	Little Snake river	Dixon road bridge	....	0.5
Sept. 27, 1911	Four Mile creek	Little Snake river	Dixon road bridge	....	0.5
May 26, 1911	Savery creek	Little Snake river	Savery, Wyo.	....	281
June 26, 1911	Savery creek	Little Snake river	Savery, Wyo.	....	132
July 15, 1911	Hunt creek	Yampa river	Bridge on road Pinnacle to Yampa	....	3.5
Oct. 30, 1911	Hunt creek	Yampa river	Yampa	....	4.5
July 14, 1911	Willow creek	Williams river	Near Pyramid	....	0.4
July 22, 1911	Willow creek	Elk river	Near Clark	....	15
Sept. 11, 1911	Willow creek	Elk river	Near Clark	....	5
Aug. 24, 1911	Poose creek	Williams river	Pyramid	....	4
July 22, 1911	So. Fork Elk river	Elk river	5 miles above mouth	....	75
May 10, 1912	Fortification creek	Yampa river	Davis ranch	4.80	60
July 1, 1912	Hot Springs creek	Elk river	Steamboat Springs	....	9.8
July 3, 1912	Big creek	Elk river	Steamboat Springs	....	205

MISCELLANEOUS MEASUREMENTS IN THE GRAND RIVER BASIN IN 1911 AND 1912

Date	Stream	Tributary To	Locality	Gage Height Feet	Discharge Sec. Ft.
Sept. 3, 1911	Plateau creek	Grand river	12 miles above Collbran	0.82	2.1
Sept. 11, 1911	Willow creek	So. Fork Grand river	Near Granby	....	18.8
Sept. 9, 1911	East Inlet to Grand lake	Grand river	Grand lake	....	9.4

MISCELLANEOUS MEASUREMENTS IN THE WHITE RIVER BASIN IN 1911 AND 1912

Date	Stream	Tributary To	Locality	Gage Height Feet	Discharge Sec. Ft.
Apr. 19, 1912	White river	....	Buford	....	331

INDEX

V

W

Y